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## THE WOODS HOLE OCEANOGRAPHIC INSTITUTION DURING WARTIME

By COLUMBUS O'D. ISELIN

*Director, Woods Hole Oceanographic Institution*

During the past year the laboratory has become almost entirely converted to war research. For example, during the summer there were about 180 people employed, but only four of these were not working under government contracts. This change-over has been a gradual one during the last three years, and the prospect is that the scope of the government research will continue to expand until the end of the war. The reason is, of course, that in a number of ways a knowledge of the physical properties of the water and of the bottom sediments can play an important part in the more effective performance of naval instruments and weapons.

Fortunately, much of this new research is not far removed from ordinary peacetime oceanography. Certainly in the case of physical oceanography the war is causing a very rapid development, but biological oceanography is by no means being neglected. Our main handicap is that it is no longer practical to send our own vessels to make observations at any considerable distance from the coast. Insurance for

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## ACTIVITIES AT THE MARINE BIOLOGICAL LABORATORY IN 1943

DR. CHARLES PACKARD

*Director, Marine Biological Laboratory*

In spite of the war, work at the Marine Biological Laboratory continues without interruption. Throughout the summer investigators have been supplied with living material, chemicals and apparatus; students in the zoology course have made collecting trips to familiar places; many readers have used the library; and the Friday evening lectures have been given as usual. But the total number of investigators and students was somewhat less than half of the normal.

Activity at the Laboratory is not restricted to the summer months. During the fall the library staff completed their work on the list of the journals now on our shelves. This was a great task, for there are more than 2,200 titles in many different languages. The list,

now published as a separate issue with the February number of *The Biological Bulletin*, has proved very useful to readers here and to those who wish microfilms of articles in the various volumes. Incidentally, our microfilm service is gradually supplanting the loaning of books during the winter. Since journals and back numbers of incomplete

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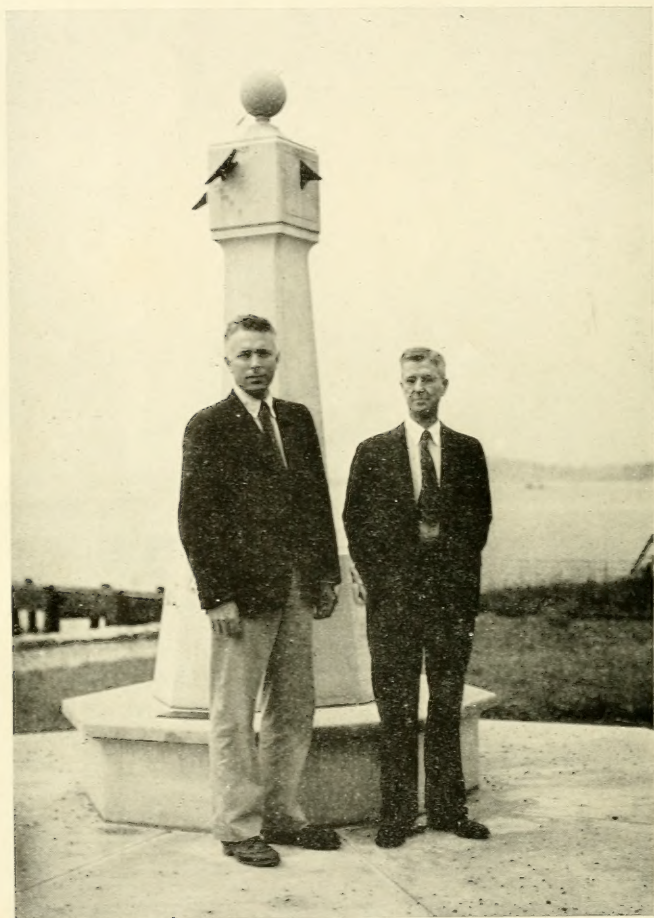
### The Eighteenth Volume

Owing to conditions brought about by the war it was not possible to publish **THE COLLECTING NET** during the summer. This single issue, briefly reviewing the season's activities, must serve as the "eighteenth volume" of the journal which has already appeared for seventeen consecutive summers, making 152 issues in all.

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DIRECTORS OF THE TWO MARINE LABORATORIES AT WOODS HOLE

Columbus O'D. Iselin, director of the Woods Hole Oceanographic Institution, and Dr. Charles Peckard, director of the Marine Biological Laboratory, standing in front of the sundial which overlooks Vineyard Sound.

sets are constantly being added, a supplement to the list will be published each year, showing what changes have occurred.

The Stone Building, a familiar landmark in Woods Hole, has now been thoroughly renovated. Although the walls stood firm, the floors and stairways had grown shaky. Now they are supported by numerous steel columns which, in the basement, stand on a new concrete floor. The original great beams themselves are perfectly sound. The entire basement is now used for storage; so also is a part of the first floor, the remainder being transformed into offices for the Supply Department. New heating, lighting and plumbing systems make the building usable at all times throughout the year. By good fortune these repairs were well under way before the use of building materials was restricted.

The Navy continues to occupy the Mess Hall and Homestead, the Lecture Hall, the Botany Building, the apartment house and the Penzance Garage. Our investigators and students now take their meals at the Nobska Inn which the Laboratory operates as a "mess," under the direction of Miss Downing. The dining rooms are not adequate to accommodate the diners, so two settings of the tables are necessary. Even then some people have to find meals elsewhere. Throughout much of the summer there has been a waiting list of those who prefer meals at Mess Hall but who can not find a place there. Because of rationing and a shortage in meat and butter, it has not been easy to provide good meals. But the staff has succeeded in their task remarkably well.

No seminars were held this summer, and there was no "General Scientific Meeting." However, the embryology course held weekly seminars which were attended by many investigators. The following "Friday Evening Lectures" were given:

#### FRIDAY EVENING LECTURES—1943

- W. R. TAYLOR, University of Michigan: "Utilization of Marine Plants."  
 D. P. COSTELLO, University of North Carolina: "Experiments on the Localization of Developmental Factors in the Egg of Nereis."  
 P. S. GALTSOFF, U. S. Fish and Wild Life Service: "The Physiology of Sex and Sex Change in the Genus *Ostrea*."  
 R. T. KEMPTON, Vassar College: "Renal Secretion."  
 L. V. HELBRUNN, University of Pennsylvania: "The Calcium-release Theory of Stimulation."  
 KURT G. STERN, Overly Biochemical Research Foundation: "Studies on Iron Proteins."  
 B. M. DUGGAR, University of Wisconsin: "Studies on the Irradiation of Certain Micro-organisms."  
 A. H. WOODCOCK, Woods Hole Oceanographic Institution: "Wind-Induced Motion of the Physalia."

The financial condition of the Laboratory is satisfactory from one point of view; from another, it is not. We are free from debt, and there is reason to believe that our income for the coming year will suffice to pay current expenses. But we are incurring obligations which sooner or later must

be met. We subscribe to many foreign journals which are now held for us abroad; for these we must pay when they can be delivered. Each year that the war continues the amount to be paid increases. Again, we are unable to purchase apparatus for replacement and for new purposes, although the need for replacements and additions is growing and must presently be met. Obviously, as soon as economic conditions return to normal, we must have funds, over and above our current income, to meet these obligations. At present no such funds are available.

Many changes in the staffs of instruction were necessary. In zoology, Drs. Waterman, Martin, Mattox and Hewatt were unable to come, being kept at home by war-time duties. Dr. Buck took charge of the course and succeeded in getting together an almost new staff. Drs. Hamburger and Costello gave the embryology course with the occasional help of Drs. L. G. Barth, Charles Metz and Meryl Rose. Miss Littrell, the assistant, was called to war service before the course ended. The physiology staff was the same as last year, but teaching duties at home and war research made it impossible for them all to be present at the same time. The course in botany was omitted because of insufficient registration. This season marks the first time in more than fifty years that the work on algae has not been given. It will be scheduled next year, as usual, in the hope that three or more students will elect it.

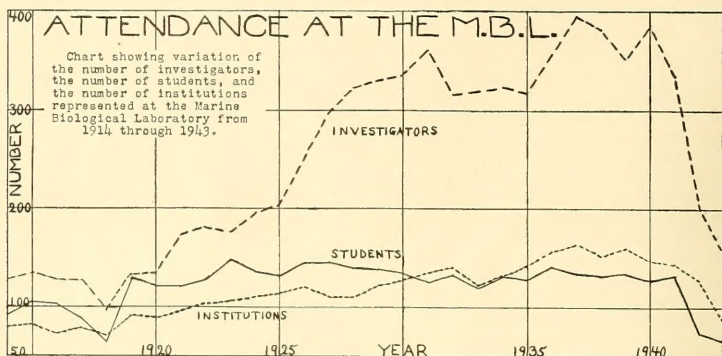
An expression of appreciation of Dr. Lillie's long and valuable services was read at the meeting of the corporation. The text is printed elsewhere in this issue of *The Collecting Net*. Dr. Lillie retired from the presidency of the corporation in 1942 after more than forty years of service as an administrator of Laboratory affairs. During this time the growth of the Laboratory in size and in prestige has been due in very large measure to his wise guidance.

The elections which took place at the meetings of the trustees and of the corporation in August resulted as follows: trustees emeritus: W. E. Garrey, B. M. Duggar; new trustees: P. S. Galtsoff, W. E. Sinnott. All of the trustees of the outgoing class of 1943 who were eligible for election were re-elected for a term of four years; Mr. D. M. Brodie and Dr. O. C. Glaser were re-elected treasurer and clerk respectively.

The new corporation members are: T. F. Anderson, University of Pennsylvania; L. V. Beck, Hahnemann Medical College; G. L. Clarke, Harvard University; E. P. Hiatt, New York University; E. P. Little, Exeter Academy; D. Nachmansohn, Columbia University; Dorothy Winch, Smith College.

Memorials were read for Dr. H. C. Bumpus, one of the most active members of the laboratory in its early days, and for Dr. G. N. Calkins, a





much loved member for nearly fifty years. Other losses by death include Dr. H. E. Howe, editor of the *Journal of Industrial and Engineering Chemistry*, Dr. F. H. Swett of Duke University, and Dr. Tracy Hazen of Columbia University.

The outlook for the future of the Laboratory is encouraging. Indeed, it is probable that after the war, the Laboratory will be more active than ever. Our regular investigators will return, and undoubtedly there will come from abroad a number of biologists who have been unable to carry on their research during the past few years. Many young investigators and graduate students who left their work to enter the armed services will resume their peace-time occupation and will come to

Woods Hole again. In anticipation of this increase in attendance, a Committee on Additional Funds consisting of Drs. D. E. S. Brown (Chairman), F. R. Lillie, E. G. Conklin, E. N. Harvey, G. H. A. Clowes (with Mr. Laurence Riggs, Dr. C. Packard and Mr. D. M. Brodie as ex-officio members), has formulated plans for setting up teaching fellowships and scholarships for biologists who will work here throughout the year; for securing funds for a new building to replace Old Main and the other wooden laboratories, and for additional endowment. In the meantime, the Marine Biological Laboratory will continue to serve biologists who are able to come to Woods Hole.

### NOTES ON LIFE AT WOODS HOLE IN 1943

JEROME F. KIDDER

*Woods Hole, Massachusetts*

During the summer of 1943 life at Woods Hole has been interesting and pleasant. How interesting must be told by future historians, for discussion and military and naval secrecy forbid.

It is hard to measure pleasure in degrees, but in spite of restrictions on gas, which applied to boats as well as cars, constant shortages of meat, regulations as to lights and beaches, Woods Hole has been crowded and happy.

Almost all the house owners came early and are staying late. Houses for rent have been scarce due to the military and naval establishments. Social life seems more as it was thirty years ago. Instead of hopping into a car and wandering all over the Cape for entertainment people have been forced to stay at home and seek their fun round their own firesides. Rationing has made entertaining difficult, cocktail parties have taken the place of dinners, and picnics have had to end at nightfall.

The two churches, Methodist and Episcopal, have lost their rectors. The Rev. Mr. Nicholson and the Rev. Mr. Green have gone into the Navy as chaplains. Services have been held each Sun-

day by visiting clergymen and the activities of each church have been carried on.

The Yacht Club has functioned with its races each Saturday, and the Golf Club has struggled on minus caddies and with an abbreviated membership. The Red Cross has been active and has done excellent work.

Aside from seeing the uniforms in the streets, the Navy wives in the stores, and the noise of planes overhead, Woods Hole has been much as usual.

The same crowds are on the beaches for the daily swim, the arrival of the mail and trains (especially the Cape Codder) furnish the main places of meeting. A cooperative store for groceries has been struggling to get started without a great deal of success. There has been a shortage of manpower so householders have had to cut their own grass and make minor repairs themselves. In many of the larger places servants are a thing of the past, but in spite of the war, Woods Hole has been much the same, a delightfully cool, quiet friendly village—rather crowded to be sure but still delightful.



## APPRECIATION OF THE SERVICES OF PROFESSOR FRANK R. LILLIE TO THE MARINE BIOLOGICAL LABORATORY<sup>1</sup>

In the history of the Marine Biological Laboratory the names of two men are pre-eminent: Dr. Whitman, who with prophetic insight, envisioned this institution as a national center of research in every department of biology, and Dr. Lillie, who transformed that vision into reality. Coming to Woods Hole first in 1891 as an investigator receiving instruction, Dr. Lillie, with Dr. Whitman, organized the course in embryology in 1893. He was appointed assistant director in 1900 at a time when the fortunes of the Laboratory were at a low ebb, director in 1908, and president of the corporation in 1926, after the successful conclusion of the campaign to obtain new buildings and an endowment. During the period from 1900 to 1942, when he resigned from the presidency, the Marine Biological Laboratory developed from a struggling organization to its present position as the leading co-operative laboratory of the world.

It is, of course, true that only by the devoted work of the members of the Corporation and the active interest of its many friends, could such an end be reached; but it is equally true that without wise guidance this effort would have failed. From the beginning, when Whitman, against every force and discouragement, fought for the principles of co-operation and independence, this Laboratory

has pursued its steady course, adapting itself wisely to new conditions as they arose, but always holding to those basic ideals. During his fruitful years as director Dr. Lillie frequently stressed these principles. "Our purpose," he wrote, "is essentially ideal, and its pursuit demands our best efforts and our loyalty." And again, "We have laid the principle of co-operation at our foundation, and we have attempted to build it into every one of our activities." In this course he has always quietly led. There has never been any thought of division since he has been in charge. Here lies his strength, and here lies the secret of the continued success of the Laboratory.

In accepting his resignation from the presidency, the Corporation and the trustees are rejoiced that he will continue his connection with the Laboratory as president emeritus. We extend to him and to Mrs. Lillie, who has so ably assisted him in the development of the Marine Biological Laboratory, our grateful thanks, and we pledge to him our best efforts to continue the work which he has so long and so wisely guided.

C. E. McCLUNG  
E. G. CONKLIN  
CHARLES PACKARD

## IN MEMORY OF DECEASED MEMBERS OF THE CORPORATION OF THE MARINE BIOLOGICAL LABORATORY

### Memorials Adopted at the Annual Meeting of the Corporation, August 10, 1943

#### GARY NATHAN CALKINS

The distinguished incumbent of the first professorship of protozoology in America, Gary Nathan Calkins, died at his home in Scarsdale, New York, on January 4, 1943, after a considerable period of ill health which was endured with characteristic cheerfulness and fortitude.

Calkins was born at Valparaiso, Indiana, on January 18, 1869, but spent nearly all of his life on the Eastern seaboard. His scientific training began at the Massachusetts Institute of Technology where, under the influence of Professor William T. Sedgwick, an interest was aroused in biology as a profession. After receiving the B.S. degree in 1890 he served until 1893 as lecturer at the Institute and also as assistant biologist to the Massachusetts State Board of Health. Then he transferred to Columbia University to study under Professor Edmund B. Wilson and received the Ph.D. degree in 1898. While a graduate student he was

appointed to the teaching staff of the Department of Zoology at Columbia, and thus began a life-long membership which in 1907 culminated in a professorship in protozoology. Calkins was for some years executive officer of the department, and retired in 1940 as professor emeritus in residence. Columbia University conferred on him the honorary degree of Sc.D. in 1929.

Calkins' devotion of his life to the study of the Protozoa was inspired both by an inherent interest in the "little animals," and the well-founded belief that they afford highly favorable material for the approach to many general biological problems. This is best exemplified by his most important treatise, "The Biology of the Protozoa" (1926, 2nd edition 1933), and his long-continued studies on the physiology and cytology of free-living Ciliates, with particular reference to the significance of fertilization and other factors influencing longevity. In this classic work he devised more exact methods of pedigreed culture, involving daily isolation of the animals, that laid

<sup>1</sup>Read at the Meeting of the Corporation

the foundations for present-day technique in the field, and he also developed what may be referred to as his philosophy of the protozoan individual. Both phases stimulated many investigators to enter similar fields.

The extensive series of important studies from Calkins' laboratory is but one of his many contributions to science. A brilliant lecturer and teacher at Columbia University and at the Marine Biological Laboratory, his courses revealed a comprehensive grasp of protozoology from both its theoretical and practical aspects that inspired many students; and his versatility was shown by numerous other activities. Thus, for example, he was consulting biologist to the New York State Cancer Laboratory at Buffalo from 1902 to 1908; lecturer before the Lowell Institute in 1907; president of the Association for Cancer Research in 1916; president of the Society for Experimental Biology and Medicine from 1919 to 1921, and director of the University Union in Paris in 1926 and 1927. He was elected in 1919 to the National Academy of Sciences.

Calkins' association with the Marine Biological Laboratory began just over half a century ago, and for about forty years he was in regular attendance as an investigator. He was a member of the Corporation for thirty-nine years, and its clerk for seventeen years; member of the Board of Trustees for thirty years, and its secretary for twelve years; member of the research staff for thirty-one years; and head of the protozoology course, which he founded, for twenty-two years.

Zoology in general and Columbia University and the Marine Biological Laboratory in particular owe to Calkins more than can be readily expressed for his scientific contributions, teaching and administrative service. All this, as well as his personal charm, unflinching enthusiasm and hearty good fellowship, was attested by his former students and associates who presented to him after retirement a volume of nearly two hundred letters of esteem and appreciation inscribed:

Gary Nathan Calkins  
Philosopher in Little Things  
and Friend.

LORANDE LOSS WOODRUFF

#### HERMON CARY BUMPUS

Hermon Cary Bumpus, trustee emeritus of the Marine Biological Laboratory, died June 21, 1943 at the age of eighty-one years. The Laboratory thus loses a member who played an active part in its development for more than forty years. Coming first to Woods Hole in 1889 when a graduate student of Whitman at Clark University, he worked here on his doctor's thesis "The Embryology of the American Lobster." In 1890 he returned to Brown University, his alma mater,

where he taught comparative anatomy for eleven years. It was during this period that he served at the Laboratory as head of the invertebrate zoology course, as assistant director from 1893 to 1895, and as clerk of the Corporation from 1897 to 1899. He was a trustee from 1897 to 1932 when he became trustee emeritus. From 1898 to 1901 he was the director of the Laboratory of the Fish Commission at Woods Hole, during which time he made a careful monthly survey of the fauna of this region. At this time also, he made one of the first statistical studies of variation and its bearing on natural selection.

Many of his students from Brown came to us with him, among whom were George M. Gray, A. D. Mead, H. E. Walter and F. P. Gorham.

Dr. Bumpus was remarkably efficient in the work of organization in all the positions which he held. At the Marine Biological Laboratory he greatly improved the equipment for work and for collecting living material. Due to his efforts the number of students at this laboratory greatly increased, eighty-five being registered one year in the invertebrate course.

To bring biology to the people was his chief interest. Accordingly he left Brown in 1901 to become director of the American Museum of Natural History in New York, where he remained ten years and carried out his long cherished plans for taking the resources of the museum to the school children in New York City, an educational project which has grown to great proportions throughout the country. Subsequently, while in the National Park Service, he developed many museums in the state and national parks. In recognition of this work he received the Pugsley Medal for his service to education.

For three years he was business manager of the University of Wisconsin, and for five years, president of Tufts College.

These are only a few of the many accomplishments of this tireless worker. He was, in the words of his student and life-long friend, Dr. H. E. Walter, "A natural teacher, an enthusiastic scientist, a remarkable executive and a genial gentleman."

A. P. MATHEWS

Lieutenant and Mrs. Louis T. Stableford are now at Boise, Idaho, where Lieutenant Stableford is now connected with the 4th Altitude Training Unit at Gowan Field.

Of eight Latin-American science fellowships recently granted by the John Simon Guggenheim Memorial Foundation, seven were awarded to biologists.

# DIRECTORY FOR 1943

## THE SCIENTIFIC STAFF

### ZOOLOGY

#### Consultants

Bissonnette, T. H. prof. biol. Trinity.  
Woodruff, L. L. prof. proto. Yale.

#### Instructors

Buck, J. B. asst. prof. zool. Rochester. in charge.  
Burbanck, W. D. asst. prof. biol. Drury.  
Burkenroad, M. D. asst. curator. Bingham Oceanographic Found. (Yale).  
Goodchild, C. G. assoc. prof. biol. Springfield, Mo.  
Grant, R. lectr. zool. and phys. McGill.  
Lochhead, J. H. instr. zool. Vermont.  
Meglitsch, P. asst. prof. biol. Herzl (Chicago).  
Pierce, Madeline asst. prof. zool. Vassar.  
Rogick, Mary D. prof. biol. New Rochelle.

#### Laboratory Assistant

Keister, M. L. instr. zool. Wheaton.

### EMBRYOLOGY

#### Consultants

Barth, L. G. assoc. prof. zool. Columbia.  
Goodrich, H. B. prof. biol. Wesleyan.

#### Instructors

Costello, D. P. assoc. prof. zool. North Carolina.  
Hamburger, V. prof. zool. Washington. (St. Louis).  
in charge.

#### Laboratory Assistants

Lehman, G. grad. teaching fel. North Carolina.  
Littrell, Jae L. teaching asst. Illinois.

### PHYSIOLOGY

#### Consultants

Amberson, W. R. prof. phys. Maryland Med.  
Garrey, W. E. prof. phys. Vanderbilt Med.  
Jacobs, M. H. prof. phys. Pennsylvania.

#### Instructors

Fisher, K. C. asst. prof. exper. biol. Toronto.  
Kempton, R. T. prof. zool. Vassar.  
Parpart, A. K. assoc. prof. biol. Princeton. in charge.  
Sichel, F. J. M. asst. prof. phys. Vermont Med.

### RESEARCH WORKERS

#### Independent Investigators

Addison, W. H. F. prof. histol. & emb. Pennsylvania.  
Ball, E. G. prof. biol. chem. Harvard.  
Barth, L. G. asst. prof. zool. Columbia.  
Berger, C. A. dir. biol. lab. Fordham.  
Brooks, M. M. res. assoc. biol. California.  
Brown, D. E. S. prof. phys. New York.  
Buck, J. B. asst. prof. zool. Rochester.  
Budington, R. A. emeritus prof. zool. Oberlin.  
Buggs, C. W. prof. biol. Dillard.  
Burbanc, W. D. assoc. prof. biol. Drury.  
Burkenroad, M. D. asst. curator. Bingham Oceanographic Found. (Yale).  
Chambers, R. res. prof. biol. New York.  
Clark, E. L. voluntary invest. Pennsylvania.  
Clark, E. R. prof. anat. Pennsylvania.  
Clement, A. C. assoc. prof. biol. Charleston.  
Clowes, G. H. A. res. dir. Lilly Res. Labs.  
Conklin, E. G. emeritus prof. biol. Princeton.  
Costello, D. P. assoc. prof. zool. North Carolina.  
Duggar, B. M. prof. plant phys. Wisconsin.  
Evans, T. C. asst. prof. radiol. Columbia.  
Failla, G. prof. radiol. Columbia.  
Fisher, K. C. asst. prof. zool. Toronto.

Gabriel, M. L. univ. fel. Columbia.  
Galtsoff, P. S. sr. biologist, U. S. Fish and Wild Life.  
Garrey, W. E. prof. phys. Vanderbilt Med.  
Glaser, O. C. prof. biol. Amherst.  
Goodchild, C. G. assoc. prof. biol. Springfield, Mo.  
Grand, C. G. res. assoc. biol. New York.  
Granick, S. asst. biol. Rockefeller Inst.  
Grant, R. lectr. zool. & phys. McGill.  
Grave, C. emeritus prof. zool. Washington. (St. Louis).

Hamburger, V. prof. zool. Washington. (St. Louis).

Harnly, M. H. assoc. prof. New York.  
Harris, D. L. res. assoc. Pennsylvania.  
Hartman, F. A. prof. phys. Ohio State.  
Harvey, Ethel B. indep. invest. biol. Princeton.  
Harvey, E. N. prof. phys. Princeton.  
Heilbrunn, L. V. assoc. prof. zool. Pennsylvania.  
Hiatt, E. P. asst. prof. New York.  
Hopkins, H. S. assoc. prof. phys. New York.  
Jacobs, M. H. prof. phys. Pennsylvania.  
Kempton, R. T. prof. zool. Vassar.  
Krahl, M. E. res. chemist. Lilly Res. Labs.  
Lavin, G. asst. chem. Rockefeller Inst.  
Lee, R. E. res. assoc. New York.  
Lillie, F. R. emeritus prof. zool. Chicago.  
Lillie, R. S. emeritus prof. phys. Chicago.  
Little, E. P. instr. science. Exeter Academy.  
Lochhead, J. H. instr. Vermont.  
Loewi, O. res. prof. pharmacol. New York.  
Marsland, D. A. assoc. prof. biol. New York.  
Mast, S. O. prof. zool. Johns Hopkins.  
Mathews, C. P. emeritus prof. biochem. Cincinnati.  
McClung, A. E. emeritus prof. zool. Pennsylvania.  
McElroy, W. D. res. assoc. Princeton.  
Meglitsch, P. asst. prof. biol. Herzl. (Chicago).  
Memhard, A. R. Connecticut.  
Metz, C. B. instr. Wesleyan.  
Michaelis, Lenor member emeritus. Rock Inst.  
Morgan, Lillian V. California Tech.  
Morgan, T. H. prof. biol. California Tech.  
Nelson, L. Pennsylvania Med.  
Osterhout, W. J. V. member emeritus. Rock. Inst.  
Packard, C. director. Marine Biological Laboratory.  
Parker, G. H. emeritus prof. zool. Harvard.  
Parmenter, C. L. prof. zool. Pennsylvania.  
Parpart, A. K. assoc. prof. biol. Princeton.  
Pierce, M. E. asst. prof. zool. Vassar.  
Pollister, A. W. assoc. prof. zool. Columbia.  
Reinhart, E. G. head dept. biol. Catholic.  
Rogick, M. D. prof. biol. New Rochelle.  
Rose, S. M. instr. zool. Smith.  
Russell, A. M. instr. Fordham U. Biol. Lab.  
Schaeffer, A. A. prof. biol. Temple.  
Scott, F. M. (Sister) prof. biol. Seton Hill.  
Sichel, E. K. head science dept. Vt. State Normal.  
Sichel, F. J. M. asst. prof. phys. Vermont Med.  
Slifer, E. H. asst. prof. zool. State U. Iowa.  
Sosa, J. M. Common Wealth Fel. Montevideo (Uruguay).  
Steinbach, H. B. asst. prof. zool. Washington.  
Stoke, A. G. emeritus prof. Mount Holyoke.  
Stunkard, H. W. prof. biol. New York.  
Taylor, W. R. prof. bot. Michigan.  
Wenrick, D. H. prof. zool. Pennsylvania.  
Whiting, A. R. guest invest. Pennsylvania.  
Whiting, P. W. assoc. prof. zool. Pennsylvania.  
Wiercinski, F. J. instr. biol. Catholic U. of America.  
Wrinch, D. res. assoc. physics. Smith.  
Zweifach, B. W. res. assoc. biol. New York.

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## The Collecting Net

A publication devoted to the scientific work at marine biological laboratories.

Edited by Ware Cattell with the assistance of Judy Woodring.

Entered as second-class matter, July 11, 1935, at the U. S. Post Office at Woods Hole, Massachusetts, under the Act of March 3, 1879, and re-entered, July 23, 1938.

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### THE EMBRYOLOGY COURSE AT THE MARINE BIOLOGICAL LABORATORY

DR. VIKTOR HAMBURGER

*Professor and Head of Department of Zoology  
Washington University*

The students and staff of the embryology course look back on a successful and satisfactory five-week period of intense study, barely hampered by wartime conditions. The innovations introduced last year stood the second test well. The experimental period of ten days, offered this time toward the end of the course, again proved to be a most valuable experience for the students. Dr. D. P. Costello guided four of the students in the art of making micro-glass instruments, and the group then performed isolation experiments on *Nereis* blastomeres successfully. Dr. L. G. Barth directed regeneration experiments on *Tubularia*; another group worked on artificial parthenogenesis and centrifugation of Echinoderm eggs, with the generous assistance of Dr. E. B. Harvey. One group produced and studied cyclopia in *Fundulus*. Members of each group reported on their results in a joint seminar.

The Wednesday evening seminars enjoyed the participation of a considerable number of investigators, and ended in lively discussions. Topics were "Embryonic Induction" (Dr. Hamburger); "Metabolism and Differentiation" (Dr. Barth); "The Role of Genes in Development" (Dr. Costello and Dr. Hamburger); "Problems of Regeneration in Amphibians" (Dr. O. Schötté). Motion pictures of fertilization, fish and amphibian development were shown on one evening. Because of the small number of investigators in Woods Hole, only few guest lectures were given. In addition to Dr. Schötté's seminar, Dr. C. W. Metz, Jr., lectured on "Fertilizin and Antiferti-

lizin," and conducted experimental work on this topic, and Dr. C. L. Yntema lectured on "Induction and Axis Determination of the Amphibian Ear."

Dr. Costello and Dr. Hamburger were the only two members of the regular staff able to be present this year. Dr. Barth and Dr. Meryl Rose very kindly consented to aid in the teaching and took over groups in which they are specialists. The assistant, Miss Jae Littrell of the University of Illinois, was called to active duty in the U.S. Marines a week before the end of the course. Of the eleven women and three men in the class, representing ten institutions, nine were graduate students.

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The present officers of the American Society of Zoologists, elected by mail ballot, are: President, Professor T. S. Painter, University of Texas; Vice-president, Professor L. H. Snyder, Ohio State University; Secretary, Dr. L. V. Domm, University of Chicago.

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Dr. Charles Packard, director of the Marine Biological Laboratory, is now resident director and assumed his full-time duties last fall. He, Mrs. Packard and their daughter, Priscilla, lived in their home on North Street in Woods Hole last winter and will do so again this winter.

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### OCEANOGRAPHIC INSTITUTION

(Continued from Page 1)

such work still remains extremely high. For this reason the *Atlantis* has been tied up at Lake Charles, Louisiana, since a year ago in June. But the Institution has been operating a number of smaller vessels at various points along the coast on a year around basis.

At the recent annual meeting of the trustees two new staff appointments were approved: Dean F. Bumpus as associate in oceanography and Louis W. Hutchins as associate in marine biology. But the main increase in our effectiveness has come from the fact that the majority of our staff are now working at Woods Hole on a full time basis, and have adequate help from technicians and assistants. In this way we have been able to tackle several oceanographic problems which until now could not be undertaken for lack of personnel. After the war these studies will constitute major contributions to the science of the sea. It is once again evident that practical applications can indeed be very stimulating to pure research.

## ITEMS OF INTEREST

The U. S. Navy is relinquishing the laboratory buildings which it preempted in 1942. The apartment house, the mess hall, and the other buildings it occupied will therefore be available to workers in 1944.

Dr. Harold C. Wiggers has been appointed associate professor of physiology in the College of Medicine of the University of Illinois. He was formerly in the department of physiology of the School of Medicine of Western Reserve University.

Professor L. William Max, assistant professor of physiology, New York University (University Heights), has been appointed visiting professor of physiology at the dental college of the same institution.

Dr. Elizabeth B. Johnson of Wellesley College has been appointed assistant professor of botany at Connecticut College.

Dr. H. D. Stalker, who received his Ph.D. degree under Dr. Curt Stern at the University of Rochester, and Dr. H. L. Carson, who received his Ph.D. under Dr. C. W. Metz at the University of Pennsylvania, have joined the staff of Washington University as instructors in genetics and cytology, respectively. Drs. G. W. Taylor and J. M. Cairns are in active duty with the armed forces.

Lieutenant and Mrs. Clinton S. Osborn and family are living in Las Vegas, Nevada, where Lieutenant Osborn is second in command of the 32nd Altitude Training Unit at the Las Vegas Army Air Field.

Dr. Henry E. Crampton has retired as professor of zoology at Barnard College, Columbia University. He owns a cottage at Woods Hole and has lived there during the summer for many years.

Dr. John Otterbein Snyder, emeritus professor of zoology at Stanford University, died in August. He was a student of David Starr Jordan and in 1925 received the appointment as director of the Woods Hole station of the United States Bureau of Fisheries.

Nathan Calkins, son of the late Professor Gary N. Calkins, who has been acting as attorney for the Civil Aeronautics Authority, has received his commission as a lieutenant (j. g.) in the United States Navy. He reported for duty at the end of August.

The title of professor emeritus of botany at the University of London has been conferred on Dr. Ruggles Gates on his retirement at the age of sixty years.

A two-page biography of Dr. Matilda M. Brooks, research associate in biology at the University of California, appears in the volume of "Current Biography" published last year.

Dr. Franz Schrader, professor of zoology at Columbia University, reviews the volume "Fundamentals of Cytology" by Dr. Lester W. Sharp in *Science* for October 22.

Dr. and Mrs. John S. Rankin, Jr., are the parents of a girl, born on August 3 in Seattle, Washington. Dr. Rankin has served for several summers as instructor in the invertebrate zoology course at the Marine Biological Laboratory.

AMERICAN ASSOCIATION OF  
ANATOMISTS

The American Association of Anatomists lost by death within one week, early in 1943: their president, Professor Edgar Allen, and their secretary-treasurer, Professor Francis Huntington Swett of Duke University. The duties of the president are being carried on by the first vice-president, Professor J. Parsons Schaeffer of Jefferson Medical College, while the office of secretary-treasurer is being filled by Professor Eliot R. Clark, University of Pennsylvania, who held the office during the term preceding Dr. Swett's election.

The regular 1943 meeting of the Association was postponed; in the place of the usual meeting, local meetings were authorized by the Executive Committee. Two such meetings were held in the week preceding Easter, one in Chicago, and the other in Philadelphia. While no general meeting was held, members were requested to send the secretary abstracts of recent research work, and these were published and distributed to the members of the association as usual.

## Beginning Investigators

Burden, Rhoda Lee biol. fel. Tufts.  
 Grell, Mary (Sister), O. S. B. Fordham.  
 Hinchey, M. C. instr. biol. Temple.  
 Hopkins, Alice Rochester.  
 Jacobs, Athleen R. teaching fel. biol. Radcliffe.  
 Jaeger, L. Columbia.  
 Jenkins, Janet Wheaton.  
 Keister, M. L. instr. zool. Wheaton.  
 Lawniczak, Mary Justitia (Sister) student. Fordham.  
 LeFebvre, P. G. res. asst. Pennsylvania.  
 Lehman, G. grad. teaching fel. North Carolina.  
 Littrell, Jae L. teaching asst. Illinois.  
 Marks, Mildred H. res. asst. Pennsylvania.  
 Mortensen, E. asst. prof. zool. George Washington.  
 Philbrick, Madeline G. Russell Sage.  
 Price, W. H. Pennsylvania.  
 Satake, J. grad. Washington. (St. Louis).  
 Wilson, W. L. grad. Pennsylvania.  
 Witkus, E. R. res. assoc. Fordham.

## Research Assistants

Abramsky, Jessie technician Rockefeller Inst.  
 Behan, Anne res. asst. Columbia.  
 Gidge, Natalie Smith.  
 Heidenthal, G. res. asst. Pennsylvania.  
 Honegger, C. res. asst. Temple.  
 Hutchinson, D. Cazenovia.  
 John, H. M. res. asst. neurology. Columbia.  
 Kawata, N. res. asst. Washington. (St. Louis).  
 Krugelis, E. res. asst. Columbia.  
 Lawler, H. C. res. asst. New York.  
 Lowenhaupt, M. grad. Washington. (St. Louis).  
 Miner, K. R. New York.  
 Odlong, T. O. res. biologist U. S. Fish & Wildlife.  
 Stern, J. R. Toronto.  
 Woodward, A. A. res. asst. Pennsylvania.  
 Yarnall, M. Pennsylvania.

## Library Readers

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 Beck, L. V. instr. phys. Hahnemann Med.  
 Boche, R. D. instr. zool. Pennsylvania.  
 Botsford, E. F. assoc. prof. zool. Connecticut.  
 Brodie, B. B. res. assoc. biochem. New York.  
 Brownell, K. A. res. assoc. phys. Ohio State.  
 Caken, R. L. res. asst. pharmacol. Yale Med.  
 Cahn, T. New York.  
 Cahnmann, H. J. res. assoc. Mt. Sinai Hosp.  
 Cassidy, H. G. instr. organic chem. Yale.  
 Chidsey, J. L. asst. prof. Wheaton.  
 Croasdale, H. T. tech. asst. Dartmouth.  
 Franklin, R. G. prof. biol. St. Josephs Seminary.  
 Furth, J. assoc. prof. pathol. Cornell.  
 Gates, R. R. emeritus prof. bot. King's College. (London).  
 Gurewicz, V. clinic asst. Bellevue Hosp.  
 Haywood, C. prof. phys. Mount Holyoke.  
 Hibbard, H. prof. zool. Oberlin.  
 Krasnow, F. head dept. biochem. Guggenheim Dental Clinic.  
 Lilly, J. C. fel. biophysics Johnson Found. Pennsylvania.  
 Lowenstein, O. clinical prof. neurol. New York.  
 Marshall, H. A. Massachusetts State.  
 Mavor, J. W. prof. biol. Union.  
 Menkin, V. asst. prof. path. Harvard Med.  
 Meyerhof, O. res. prof. biochem. Pennsylvania.  
 Molderover, J. res. asst. neurol. Columbia.  
 Nachmansohn, D. res. assoc. neurol. Columbia.  
 Schmitt, F. O. head dept. biol. M. I. T.  
 Silow, R. A. geneticist. Cotton Res. Sta. (Trinidad).  
 Stahmann, M. A. res. asst. chem. Rockefeller Inst.  
 Stern, K. G. chief chemist, Overly Biochem. Res. Found.  
 Wolf, O. M. assoc. prof. Goucher.  
 Woodward, A. E. asst. prof. Michigan.  
 Yntema, C. L. asst. prof. anat. Cornell Med.

## STUDENTS

Andrus, Mary Wellesley. zool.  
 Aronson, S. M. CCNY. biol. teaching fel. emb.  
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 Banks, Mary Elizabeth Washington. undergrad. asst. emb.  
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 France, H. O. res. fell. biol. phys.  
 Getz, Charlotte E. Chicago. zool.  
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Cuba  
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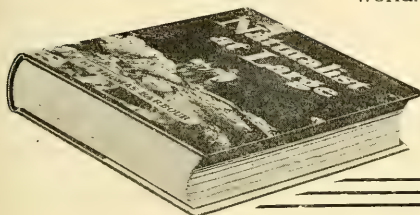
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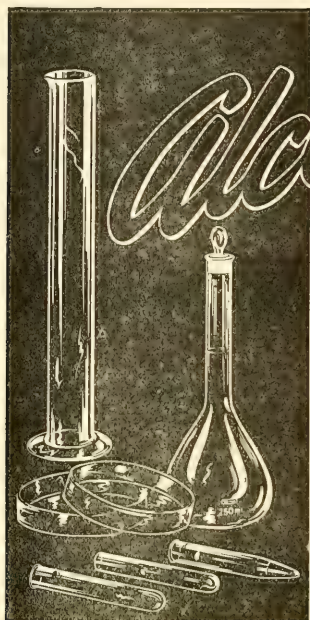
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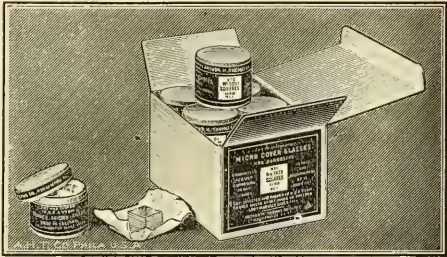
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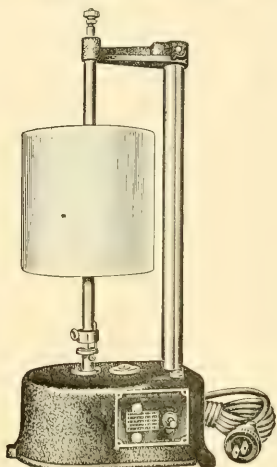
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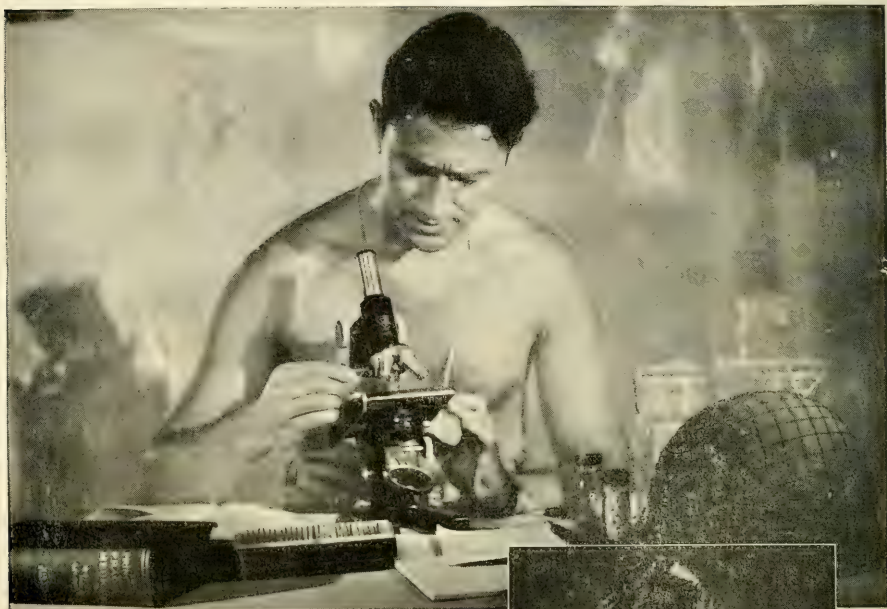
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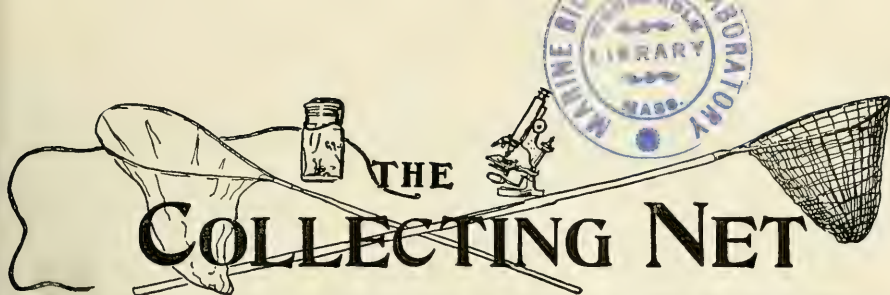
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## RECONVERSION AT THE WOODS HOLE OCEANOGRAPHIC INSTITUTION

C. O'D. ISELIN

*Director, Woods Hole Oceanographic Institution*

Although the war has been over for nearly a year, at the Woods Hole Oceanographic Institution we have only just begun to reconvert. There are several reasons for this delay. For a basis research laboratory to take up the practical applications of science has somewhat the effect of whiskey. A little of it is stimulating and very pleasant. The danger is that once you begin to indulge, it is very difficult to stop. The Navy's experiments at Bikini Atoll are a second potent reason why our staff is still as large as at any time during the war when there was good reason for our helping to develop some of the practical aspects of oceanography.

The atomic bomb experiment, especially the second phase of it, is actually a major event in oceanography. We could not afford to miss it. On the physical side it will provide opportunity to measure directly vertical and lateral turbulence in the sea. The dispersion of radioactive material by turbulence and by currents is the ideal way in which to study

(Continued on Page 11)

## THE FIFTY-NINTH SEASON OF THE MARINE BIOLOGICAL LABORATORY

DR. CHARLES PACKARD

*Director, Marine Biological Laboratory*

The 59th season of the Marine Biological Laboratory opens with much of the old-time activity familiar to those who were here before the war. Every day we see old friends who in the years just past worked elsewhere on defence projects or in summer teaching

and we meet many new comers. Among the latter are veterans whose studies were interrupted by the call of their country and who now are able to take up their work once more. We have greatly missed them. During the past seasons only an occasional man could be found in the classrooms; the tables for beginning investigators were almost empty. But now we have returned to our normal condition, for which we are all profoundly grateful.

The increase in attendance has introduced a new problem. We have been unable to provide living space for many who planned to come to Woods

Hole. Even though all rooms in the Laboratory residence buildings are assigned and though we have additional space in the Fisheries residence and have utilized all available rooms in the vil-

### M. B. L. Calendar

FRIDAY, July 26, 8:00 P. M.

Lecture: Prof. K. S. Cole: 'A' Bomb and Biology.

TUESDAY, July 30, 8:00 P. M.

Seminar: Dr. Ernst Scharrer: Chemical Sense and Taste in the Sea Robin.

Dr. Claude Villee: "Studies of the Respiration of the Imaginal Discs of *Drosophila*, Using the Cartesian Diver Ultra-microrespirometer.

Dr. C. B. Anfinsen and Dr. Eric G. Ball: The Action of Naphthquinone Antimalarials on Respiratory Enzymes.

FRIDAY, August 2, 8:00 P. M.

Lecture: Dr. Eric G. Ball: Biochemical Studies on the Malarial Parasite.

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AN AERIAL VIEW SHOWING THE LOCATION OF THE THREE BIOLOGICAL LABORATORIES IN WOODS HOLE

lage, we are still in need of more. The housing shortage, a lack of research space, has restricted our numbers.

This bad situation can be partially corrected when our investigators are able to build their own homes. To provide space for them the Laboratory is opening up a part of the Devil's Lane Tract which lies between the State Road to Falmouth and the railroad. The preliminary survey is practically finished and as soon as possible the new roads through the tract will be roughed out. There will be somewhat more than 100 lots available, each about 150 by 100 feet. Some are situated along the Falmouth and Shore roads, others in the woods which lie between. Already considerable interest has been shown in this property and without doubt houses will be erected there as soon as building materials can be had.

To maintain the Laboratory buildings in good repair has been difficult in the past few years but now, with materials and labor available, we can begin to put them in order. Last summer a committee, headed by Mr. Claff, made a survey of all the laboratories and residences and reported in detail what should be done. Already some of the improvements which were recommended have been made. The Mess, particularly the kitchen which was not restored after the Navy left it, is now in excellent condition thanks to Miss Downing's planning and to our Laboratory staff who did the work. The Botany Building also has been restored to usefulness with new plumbing, many new furnishings and fresh paint. It is now in better shape than ever before. Other improvements have been made in the Rockefeller Building and in the Supply Department. Finally, the leaking walls of the Brick Buildings are in the process of repair. When the work is finished the laboratory rooms which have been damaged by water driven by winter storms, will be made presentable. Much remains to be done but it is hoped that by next year all of the essential repairs can be completed.

The Friday Evening lectures, which have been

### FISH AND WILD LIFE SERVICE STATION AT WOODS HOLE

The U. S. Fish and Wild Life Service maintains a station in Woods Hole directly across from the laboratory mess hall. The station is engaged in investigating the fish and shell fish of the North Atlantic in addition to maintaining a fish hatchery for marine species.

The conversion of an 18 foot Navy ship is another current activity. The Albatross III, as she is to be called, was scheduled to be refitted the early part of July.

given every season for nearly two generations, have already begun. The first lecturer, Dr. Jane Oppenheimer, will be followed by Dr. E. N. Harvey, B. W. Zweifach, E. W. Dempsey, K. S. Cole, E. G. Ball, M. H. Jacobs, E. J. Cohn, P. R. Burkholder, and E. J. Boell. The speakers discuss the general problem in which they are interested and present in some detail their own contribution to the subject. Seminars are being arranged for each Tuesday evening as usual. In addition there may be special lectures from time to time.

Two matters of community interest should be mentioned. The first is the parking problem. Everyone has noticed that our narrow main street is already filled with cars and that two-way traffic is difficult, if not impossible. There is danger that parked cars may be side-swiped; furthermore, fire engines are hampered. Car owners are therefore urged to park their cars on the Laboratory lots rather than in the streets. There is a parking place along the Eel Pond wall and back of the Brick Building; another is next to the Carpenter Shop; a third, between the Howes and Kidder houses, and a fourth, opposite the Apartment House.

The second matter is the fire hazard, particularly in the woods. Many trees, blown over by the hurricane, still lie where they fell and are now dry and highly inflammable. A match or cigarette carelessly thrown away might start a costly fire. The great conflagrations which swept over parts of the Cape during the spring showed what happens as a result of carelessness. Everyone walking in the woods should constantly keep in mind the danger of fire.

For many years the Laboratory has been running under reduced sail; we have been unable to carry out plans for its improvement; we have lacked many things considered essential and our attendance has been small. But despite the difficulties and disappointments the Laboratory has carried on, thanks to the unfaltering spirit of its members. Its future is full of promise.

During the years 1942-1944, the Navy took over the station as a section base. Mr. Gordon Davis, the superintendent, reports that the base was decommissioned in January 1944 and while reconversion has not been entirely completed, the station will soon be open to the public. Mr. Davis promises that before the end of the summer there will once more be a chance to enjoy the varied exhibits of the aquarium.

## THE ORGANIZATION OF THE TELEOST BLASTODERM

DR. JANE M. OPPENHEIMER

*Assistant Professor of Biology, Bryn Mawr College*

The work on the early development of the teleost blastoderm has represented, to a great degree, a rather rough repetition of parts of the more meticulous experimental analysis previously performed on the eggs of amphibians. There has been no attempt to work out the details of the developmental pattern as accurately in the teleost as in the amphibian; once the teleost egg was shown to conform to the general pattern first described for the amphibian, no great interest in the more precise details was developed; and the technical procedures of handling the teleost egg have not yet been so successfully perfected as in the case of the amphibian material. When vital stains, for instance, are applied to the teleost blastoderm they remain more diffuse than in the amphibian and spread more rapidly. These technical difficulties are not insuperable, but as yet no one has troubled to overcome them.

The recent experiments on the eggs of the teleost have been performed largely on two forms, on the trout in Belgium and Germany, and on *Fundulus* in this country. The developmental patterns of these two forms have been shown to be fundamentally similar to that of the amphibian, but they vary from the amphibian type in some interesting details. Furthermore, while these two teleost forms resemble each other in many respects, they differ in other respects, and the divergencies are particularly interesting in that they may provide a starting point for new studies yet to be performed.

The teleost egg, it will be remembered, is characterized by a relatively large fluid yolk surrounded by a blastodisc. The yolk, confined by a plasma membrane continuous with the blastodisc, takes no active part in morphogenesis, in the sense that it is extra-cellular so far as the dividing cells of the blastodisc are concerned. The blastodisc alone cleaves, and forms the embryo. When cleavage has proceeded for an appropriate period, the blastoderm flattens on the yolk and gradually expands to cover it. In *Fundulus*, when the process of expansion gets under way and gastrulation begins, the blastoderm thins out, eccentrically, in such a way that the thinner central area, the extra-embryonic epithelium, is surrounded at the periphery by a thicker rim, the germ-ring. At one point on the periphery the thickening of the rim extends further centrally in the blastoderm than elsewhere: this region is the embryonic shield. Its long axis will become the longitudinal axis of the embryo and along it are distributed the cells which are involved during the course of gastrulation.

As the blastoderm gradually expands to cover the yolk, the shield increases in length and the

cells which are to form the roof of the archenteron move in below the surface at its posterior lip. In *Fundulus*, where the yolk is smaller in proportion to the blastoderm than is the case for the trout, very little differentiation has occurred in the shield at the time that the yolk is completely covered by the blastoderm: the solid keel which sinks down to form the central nervous system is usually the only visible organ-rudiment. In the larger-yolked trout, the nervous system is more highly differentiated and eyes, otic vesicles, and somites are well demarcated by the time the yolk is covered.

The method of local vital staining has been applied to the blastoderms of both trout and *Fundulus* in order to ascertain the roles played during morphogenesis by particular groups of cells. The experiments indicate that in *Fundulus* the prospective nervous system area is found largely in the anterior and middle portion of the early shield; the whole area elongates, during gastrulation, along the embryonic axis, its anterior portion more than its posterior portion. Some material from the sides of the shield converges towards the midline to form central nervous tissue. The anterior portion of the area in the early shield does not represent the anterior-most tip of the nervous system: some material for the brain is contributed to the shield from the extra-embryonic epithelium during the course of gastrulation. The exact limits of the areas for endoderm and chorda have not been too precisely established for *Fundulus*. It is clear, however, that the prospective endoderm is localized in a crescent along the lip of the embryonic shield and that the prospective notochord area lies between this and the cells of the prospective nervous system. The prospective mesoderm lies in the lateral parts of the early shield and in the germ-ring and its cells converge towards the midline and involute to take their place in the underlying layers as the shield increases in length. The part of the germ-ring most remote from the embryonic shield contributes to the formation of the tail-bud blastema.

The map of prospective areas in the blastoderm of the trout, as worked out by Pasteels, shows a comparable localization of most of the areas. The principal difference from the conditions described for the *Fundulus* lies in the fact that in the trout the material for the central nervous system is located in a wide crescent, as in the amphibian, whose cells must undergo considerably more convergence towards the midline than in the case of the *Fundulus*. In both types of teleost embryo, however, as in the amphibian, the cells attain their



final position in the embryo by undergoing combined movements of involution, convergence and extension of groups of cells. These movements have been described for the trout in considerable detail by Pasteels, who has presented some excellent diagrams elucidating them.

The first transplantation experiments performed on teleost eggs were, like the vital staining experiments, repetitions of experiments performed previously on the amphibian embryo. The first grafting experiments performed on *Fundulus* involved the transplantation of the lip of the embryonic shield, which includes a group of cells comparable to those contained in the dorsal lip of the amphibian blastopore. Secondary embryos are induced as a result of the implantation of such grafts either into the embryonic shield or on extra-embryonic epithelium. In the case where implantation of the grafts is made into the shield, the structures constituting the secondary embryos are located at the same antero-posterior level as are comparable structures in the primary or host embryo. Conditions are otherwise, however, in the case where grafts of the shield lip are implanted into the extra-embryonic epithelium: here corresponding structures are not found at the same antero-posterior level in primary and secondary embryos and the nature of the structures induced in these cases is presumed to be determined by qualities inherent in some of the grafted cells. The fact that structures induced by grafts to the extra-embryonic membrane are apparently not greatly influenced by the primary embryo, renders this location a highly favorable one for the study of problems involving the fundamental nature of the inductive processes—an advantage which has unfortunately not as yet been adequately exploited.

The mode of action of the dorsal-lip "organizer" in the teleosts has been analyzed in somewhat greater detail for the trout than for the *Fundulus*. Luther, in order to demonstrate the existence of an "organizer" in the teleost egg, transferred the invaginated archenteron roof of the trout gastrula from the embryonic area to the region of the blastoderm farthest removed from the embryonic axis, implanting it between the blastoderm and yolk and found that it induced the formation of a secondary embryo. Luther demonstrated further the inductive powers of the archenteron roof by repeating one of the classical experiments from amphibian embryology, namely, by rotating through 180 degrees a square of blastoderm including prospective epidermis and prospective central nervous system regions, in such a way that these areas were interchanged in position; the prospective nervous system cells that were not underlain by archenteron roof differentiated only epidermis; the prospective epidermis cells, underlain by the

archenteron roof, differentiated typical brain structures. Luther showed, furthermore, that in the trout, as in the amphibian, the implantation of other agents than the roof of the archenteron could invoke the inductive processes; nerve tissue from older trout larvae and Triton liver were found to induce abortive differentiation.

Regional differences in the activity of the archenteron roof have been analyzed by Eakin for the trout embryo in an ingenious series of experiments. Eakin divided the archenteron roof of young trout gastrulae into an anterior, a middle, and a posterior portion, implanting each of these, wrapped in a small jacket made up of the extra-embryonic half of a late gastrula, to the yolk-sac of a trout larva with large yolk-sac. In each case the graft was accompanied by a small control graft consisting only of a tube of extra-embryonic ectoderm obtained from a late gastrula: in no case did the tube grafted alone undergo differentiation. The anterior piece of the archenteron roof differentiated principally digestive epithelium and exerted little if any inductive influence on the adjacent cells from the epidermis: the middle piece differentiated chorda, muscle segments, gut and pronephic ducts and induced the formation primarily of brain tissue and auditory vesicles. The posterior piece differentiated chorda, muscle segments, gut and pronephic ducts and induced the formation of nervous tissue resembling spinal cord. The middle piece of archenteron roof corresponds thus to the "head organizer" of the amphibian gastrula and the posterior piece to the "trunk organizer".

All of the experiments outlined above, whether performed by vital staining or transplantation techniques, have in fact indicated the fundamental similarity of developmental pattern which characterizes the amphibian and teleost gastrula. The differences which distinguish the amphibian from the teleost pattern are some of them probably related to the differences in the relationship between yolk and embryonic cells which are distinctive of these two classes. While the trout and *Fundulus*, however, follow in general the same developmental sequences, there are apparently some features which distinguish these two teleostean developmental types one from the other. These are related to the manner in which the various parts of the blastoderm as a whole are integrated with each other to form an organized working whole.

The experiments which have revealed these differences have involved the isolation of various parts of the blastoderm and the study of their subsequent development. In the experiments on the trout, sections of the blastoderm were implanted on the yolk-sac epithelium of older larvae. Quarters of the blastula were treated in this fashion:

each quarter was found capable of differentiating gut, chorda, striated musculature, nervous system, auditory vesicles, and so forth. The gastrula was divided in one series of experiments into six sectors, called respectively the embryonic sector, the lateral embryonic portion (on either side of it), the lateral extra-embryonic portions (adjacent to the lateral embryonic ones) and the middle extra-embryonic portion. At the pastrula stage, a gradation of potencies becomes apparent when the differentiation of these parts in isolation is studied. Differentiation occurred in 97% of the embryonic sectors and in 84% of the lateral embryonic portions of gastrulae of varying ages, in 42% of the lateral extra-embryonic and in 20% of the middle extra-embryonic portions at the early gastrula stage. At a later gastrula stage the percentages of grafts differentiating from the lateral embryonic portions and from the lateral and middle extra-embryonic portions were strikingly reduced even further reduction occurred when the lateral and middle extra-embryonic portions of the neurula were grafted.

There is thus at all stages gradation of potency for differentiation in the various parts of the blastoderm, the potency being the highest at the embryonic area and lowest at the region farthest away. With increasing age a further diminution of potency occurs in the extra-embryonic regions. Luther has performed additional experiments, the results of which substantiate the existence of the postulated gradient in the trout, by deleting varying amounts of the embryonic region and finding that small defects can be followed by regulation and embryo-formation, while large ones cannot. He has, in addition, substituted extra-embryonic material in the embryonic sector in various ways and the results of these implantations experiments have been compatible with the notion of a gradient.

No such gradient has been observed to exist in the egg of *Fundulus*. In this form, however, the experiments designed to test the potencies of the outlying parts of the blastoderm were performed in a slightly different way than in the trout. Small portions of the germ-ring, removed from regions 90° or 180° away from the embryonic axis, were grafted into the embryonic shield or on the extra-embryonic membrane of the embryo the same age as the donors. Such grafts implanted on the extra-embryonic membrane failed in all except one case to differentiate any structures except epidermis blood cells and chromatophores, no matter what the age of the donor embryo and irrespective of the source of origin of the graft. The same fact was true for grafts which became located in the pericardium. In contrast, grafts from the 90° and 180° germ-ring of gastrulae of various ages, implanted into the shield, differentiated without exception provided their cells were incorporated below the epidermis. The nature of the structures

differentiated bears no relationship to the source of the grafts; head, trunk and tail-structures were formed in grafts from both 90° and 180° regions of the germ-ring: in some cases, grafts form characteristic neither of the region of the host to which they were transplanted nor of the region of the embryo for which the grafted cells were originally destined: that is, 180° germ-ring could differentiate pronephros when implanted into the brain-region of the host.

Clearly then, there is no gradation of potencies around the germ-ring of the *Fundulus* blastoderm and what potencies the cells of the germ-ring possess for differentiation are expressed only after the interaction of these cells with those of the embryonic shield.

The behavior of the extra-embryonic germ-ring isolated with respect to the embryonic shield has been studied in a different fashion in the egg of the tropical *Cyprinodont epilatys fasciolatus*. In this form the whole egg can be cut into two halves at late gastrula stages, one containing the whole embryonic shield, the other containing the part of the germ-ring originally most remote from the shield. The latter group of isolates exhibit a most striking behavior: the germ-ring cells form tail-like structures similar in shape to the tail of the normal embryo. When these structures are studied in section, they are found not to have undergone histogenesis, with the exception of occasional differentiation of chromatophores or blood cells.

On the other hand, if the tail-bud region is isolated from an *Epilatys* embryo at the early somite stages, it undergoes normal histogenesis of nerve cord, chorda and somites. Presumably, then, some interaction between the cells of 180° germ-ring and the embryonic shield is required if these germ-ring cells are to undergo histogenesis, though this interaction is not necessary if the cells are to produce tail-form. This may well be material in which the factors which are responsible for differentiation of form can be separated from those which govern histogenesis and hence favorable material for a satisfactory analysis of these agents.

The teleost group, indeed, may provide a good starting point, in many respects, for some of the embryological problems of the future. The advantages of the extra-embryonic epithelium for the study of the nature of the inductive processes have already been mentioned. The physiological embryologist who can provide a physiological description of the two different known types of teleost blastoderm will make a desirable contribution to our knowledge of the developmental processes; for ultimately our understanding of these processes may derive as much from an analysis of differences in developmental pattern as from an emphasis on similarity of type.

**THE EMBRYOLOGY COURSE**

DR. DONALD P. COSTELLO

*Instructor in Charge; Professor of Zoology  
University of North Carolina*

The main purpose of this course is to acquaint students possessing a research interest in biology with the living, developing organism. The opportunity for studying development as a dynamic process in a wide range of living forms is unique and the advantage of forming a concept of development based on observations in a continuous sequence from the unfertilized egg to the complex organism cannot be overemphasized. The variety and wealth of invertebrate forms, in particular, afford material on which some of the fundamental problems of development can be investigated and open new vistas to the student who has been trained in the traditional embryology of frog, chick and pig.

Descriptive embryology and the observation of normal development constitute the backbone of the course. The modern trend toward experimental embryology, however, is strongly emphasized. In accordance with the policy inaugurated by Dr. Viktor Hamburger in 1942, a special nine-day period at the end of the course is devoted exclusively to experimental work. During this period the class will be divided into eight groups of three or four students. Each group will do a series of experiments under the guidance of an instructor or adviser. On the final day of the course representatives of the different groups will report their work in seminar session.

This year Dr. P. B. Armstrong will supervise the work of a group on teleost material. Other groups will work on blastomere-isolation technique on the eggs of *Arbacia*, *Hydractinia*, *Nereis* and *Ilyanassa*; on the production of twins in annelids; and on the production of cyclopia in teleosts. Regeneration of hydroids and certain aspects of the fertilizin problem also will be studied.

The series of Wednesday evening embryology seminars, instituted by Dr. Hamburger in 1942, has been continued. The purpose of these seminars is to stimulate an informal discussion in which the students will participate. Dr. Jane Oppenheimer conducted the first seminar on "Some Problems of Embryology". Because of the large attendance at the next seminar ("The Role of Nucleic Acid in the Cell and in the Embryo"), given by Professor Jean Brachet of the University of Brussels, it was necessary to change the place of meeting from the embryology laboratory to the auditorium. A similar change from the less formal surroundings was required for the seminar on "Function in Development", conducted by Dr.

Armstrong on July 2. Additional seminars are planned for the remainder of the course.

Special lectures on different aspects of development have been a valuable part of the course for many years. This year the class had the great privilege of hearing Dr. E. G. Conklin discuss past and present problems of embryology with interesting comments on the contribution of the earlier investigators of the Marine Biological Laboratory.

Dr. F. R. Lillie has kindly donated to the embryology course the original drawings used for his 1912 paper on fertilization of the egg of *Nereis limbata*. These were drawn by Mr. Kenji Toda from microscopical preparations made by Miss Dolores Brockett. The mounted drawings are now on exhibit in the embryology laboratory. Dr. E. G. Conklin also donated to the course about 175 prepared slides of several stages of the development of *Crepidula* which were used by the students this year for the study of cell-lineage.

There have been a number of changes in the course staff. Dr. Viktor Hamburger of Washington University, instructor in charge of the course from 1942-45, Dr. W. W. Ballard of Dartmouth College and Dr. Jane Oppenheimer of Bryn Mawr College, resigned from the embryology staff. The present staff of instruction includes Dr. Howard L. Hamilton, assistant professor of zoology, State University of Iowa; Dr. John A. Moore, assistant professor of zoology, Barnard College; Dr. Albert Tyler, assistant professor of embryology, the California Institute of Technology; and Dr. Donald P. Costello, professor of zoology, University of North Carolina, instructor in charge of the course. Course advisers include Dr. P. B. Armstrong, professor of anatomy, Syracuse University and Dr. H. B. Goodrich, professor of zoology, Wesleyan University. The assistants are Catherine Henley of the Johns Hopkins University and Eleanor Lerner of Washington University. Marjorie Hopkins Fox of the University of California is serving as research assistant, testing projects for the experimental period and preparing a laboratory guide of Woods Hole embryological material.

For the first time since the war began the enrollment in the course has reached its upper limit. Thirty students (18 men and 12 women), representing 24 institutions, were selected for admission from a considerably larger group of applicants.



### EMBRYOLOGY CLASS NOTES

This year's embryology class is a heterogeneous group, coming from Canada, China and Hawaii as well as many states—representing thirty-five colleges and universities. East and West are so well represented that opinion is divided on such things as lobsters—the eastern kind being larger and more delectable than the Pacific species, and types of *mytilus*—the western type being attacked by a toxic dinoflagellate at certain seasons while the eastern type is always edible—when available. These heated discussions were occasioned by plans for the annual embryology class picnic.

Everything was ready on the morning of June 29 except the *mytilus*. Five of the huskiest men in the class with a battered lab. assistant as navigator had gone out the day before, searched all afternoon and returned with four minute *mytili*; hence clams were bought in Hyannis.

According to those familiar with embryology outings for many years, this one was a picnic to end all picnics. The weather was with us and so were fifty-five lobsters, sixty pounds of clams, celery, carrots, olives, plenty of butter, beer, good cake and the *pièce de resistance*—watermelon carved in the Costello manner to look like two magnificent flowers with red petals and green sepals. The eating began with carrots as, fifty-two strong, we left for Tarpaulin Cove aboard the good ships *Nereis* and *Playmate*. The spray of water and wind made the trip to Naushon, the long way around through Woods Hole and Robinsons Hole, very enjoyable. Tarpaulin Cove's fine white sand was invaded first by swimmers and then by people in boats. Eating continued on a grand scale and was followed by softball (starring Dr. Tyler), swimming, rowing, hiking and more eating. When fifty-two tired and well-fed people left the cove, the day was con-

sidered a complete success. What had been undisturbed white sand looked like the aftermath of a hurricane. Everything was fine till that evening. We realized then that something had been wrong with the lobsters since everyone who ate one turned bright red—the color was there though the segments were not.

In between picnics we spend some time occasionally in the laboratory. Laboratory work and lectures have been enhanced by outside speakers as in former years. Laboratory work has included development of teleosts and the squid under Dr. Hamilton; fertilization and development of *Nereis* and *Chaetopterus*, cell lineage, annelids and mollusks under Dr. Costello; and echinoderms under Dr. Tyler. The first seminar of the season was given by Dr. Jane Oppenheimer on "Some Problems of Embryology." Dr. Jean Brachet directed a stimulating seminar on the subject of "The Role of Nucleic Acid in the Cell and in the Embryo." The third seminar, which was conducted by Dr. P. B. Armstrong, was on "Function in Development." These meetings stimulated formal and informal discussions afterwards. Invariably after a seminar a group gathers in the lab to discuss it and then drifts into other subjects of interest. One of the highlights of the course so far has been a lecture given by Dr. E. G. Conklin in connection with our study of *Crepidula*. He told of embryological theories current when he began his work and outlined some of the problems he would like to see tackled now. To listen to a successful embryologist who began his work in a situation similar to ours was a real inspiration. The philosophy and unquenchable enthusiasm of a man who has spent his life as a scientist is a stimulus to a beginner and sets a goal worthwhile attaining.

—E. M. S.

### THE BOTANY CLASS AT THE MARINE BIOLOGICAL LABORATORY

DRS. MAXWELL DOTY AND HANNAH CROASDALE

*Northwestern University and Dartmouth College*

The botanists this year, having recovered their quarters on the second floor of the botany building, set out on schedule, June 2, to examine the algal flora of the region. This year the course has been deprived of the inspiration and able direction of Prof. W. R. Taylor, who was snatched by "Uncle" for the "before and after" survey of algal life around Bikini atoll. The responsibility of introducing this year's class to the algae was taken over by Drs. Hannah Croasdale and Maxwell Doty. The former, from Dartmouth College, is a long-time Woods Hole. She is lecturing on the fresh-water groups and doing the collecting for the course. Dr. Doty is a newcomer to the east coast, being from Northwestern University. He is lecturing on the marine groups and, being originally from the Pacific coast, is

engrossed in a new and interesting flora. They are being assisted in the laboratory and in the field by Miss Alma Dietz from the American International College in Springfield, Mass. Alma was here last year as a student and is back again for more punishment.

Not only is botany happy with its building, newly refurnished by the M.B.L. after the Navy's occupation and with the doubling of the enrollment, but with the prospects! The class may not be up to the overflowing state so conspicuous in the cases of its fellow courses, but it is now strong enough to make its voice heard. In fact with Dr. Taylor back next year we face the prospects, too, of overflowing and requiring more room! Things certainly do look bright on the botany side of the Rockefeller building.

## BOTANY CLASS ACTIVITIES

July 2—Official welcome by Dr. Maxwell Doty, Dr. Hannah Croasdale and laboratory assistant, Miss Alma Dietz . . . A hurried exchange of introductions and the algae class of 1946 was underway . . . The initial instructions for the much awaited field trips left us in anticipation of the weeks to follow . . . A general survey lecture on Myxophyceae followed by an intense microscopic search for some of the genera and we began to feel like true Botanists . . . ?

July 3—Our first field trip . . . grand assemblage . . . kits, bottles, buckets and us . . . all by truck to Sippiswissett Salt Marsh, Cahoon's Ice Pond (Were those really hot springs and mountain brooks???) . . . Whittemore Pond, Flax Pond and Week's Pond . . . a wealth of material collected. . . Well, at least we thought so! . . . a mad scramble for a swim . . . dinner . . . then back to the lab for search and discovery . . . then true to Woods Hole tradition our first Botany Tea Party . . . more introductions . . . we felt like one big family . . . and did we love it . . .

July 4—More searching . . . more discoveries!! Boy, were those blue-greens difficult to find!! The eternal question . . . what is a Desmid ? ? ?

July 5—Our knowledge increases . . . an interesting lecture on the Chlorophyceae . . . another trip . . . Mr. Edward Moul and Miss Gladys Bulmer join the group . . . We are covering the Cape . . . Trout Pond, Cedar Lake, Summerfield Ponds, etc. . . time out from algae. . . our interest shifts . . . three-legged frogs . . . fruiting sphagnum . . . and the solar house . . .

July 6—A chance to check ourselves . . . identifying our own collections . . . Isn't lab work fun!!! More desmids . . .

July 8—Botany seminar . . . Dr. C. K. Tseng, head of the botany department, National University of Shantung in Tsingtao, spoke on the "American Algae Industry" . . . Did we look forward to becoming true Woods Holes??? Monday night initiation . . . our surprise, *Mytilus* surely tastes good !!! More introductions . . . we are getting around!!!

July 9—Algalogists, at last!!! Cedar Swamp, Gifford's Bog . . . mud and more mud . . . But our efforts reaped rewards; our collections contained greens . . .

Off to mess.

—M. F. and M. K.

## PHYSIOLOGY CLASS NOTES

For the past three weeks the Physiology Class has been listening to an excellent series of morning lecturers. Dr. Ramsey opened the season June 25 with three lectures covering muscle and nerve excitation and conduction and the membrane hypothesis. Dr. Giese followed with three blackboard talks on the effects of radiations, emphasizing specific absorption phenomena in the ultra-violet and the affects of x-inadiation. He was followed by Dr. Harvey, who gave a thoroughly enjoyable lecture on bioluminescence and the oxidative processes involved. The last three speakers were: Dr. Cole, who discussed the permeability of membranes and their measurement by electrical methods, Dr. Blum, who covered photodynamic action and its oxidative processes and Dr. Chambers, who lectured on micromanipulative studies on living cells.

The second phase of the course opened with three lectures by Dr. Parpart (no mustache, see *Collecting Net* 16, 82, 1941). He discussed permeability, including methods in permeability, and the nature of the cell surface. Dr. Barron gave three of a series of four fine lectures on respiration and the respiratory enzymes. Dr. Chase will carry on this week with photo-chemistry.

Laboratory work, however, has constituted the greater part of the course. One week was spent under two of the three instructors: Drs. Ramsey, Giese and Chambers, at the student's choice. Similarly, during the second two week phase, one has

a choice of two of the three: Drs. Parpart, Barron and Chase. In spite of the course's record registration of 26 students, there is still enough work for all.

The first session of the course so far was the group meeting at the end of the first two weeks' work. Members of the course reported on their work and there was outspoken discussion on many of the papers. An outstanding contribution was by a prominent doctor, wherein he successfully reduced the science of muscle measurements to a factor of ten.

One morning this past week, after a strenuous post-lecture discussion, the cry went up that a torpedo had been brought in. Consequently, the whole class, as well as most of the MBL, appeared at the dock—sinking it to a depth of two shoe-soles—and watched or participated while Dr. Parpart—adept in these matters—utilized a varying number of students or individuals, depending on the torpedo's cooperation. Incidentally, the *Nereis* had also brought in a walloping sting ray, as well as a goose fish that made one wonder about picnics at the beach.

Coming up next Saturday, the 20th, is the big time of the season. Class, faculty and guest lecturers, plus any wives, are scheduled for the annual picnic. Dave Jofter is chairmaning the affair and has a worthy chef in Doc Abajian. The shortage of cereal grain has us a little stumped.

—XYZ.

## The Collecting Net

A bi-weekly publication devoted to the scientific work  
at marine biological laboratories

Edited by Ware Cattell with the assistance of Ruth  
Scott, Susan Straus and Jane Carruthers.

THE SCIENCE PRESS

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Woods Hole, Mass.

### Introducing

Albert Froelich, M.D., associate pharmacologist at the May Institute for Medical Research of the Jewish Hospital in Cincinnati. Former *emeritenti ordentlich professor Pharmakologie* at the University of Vienna.

Dr. Froelich learned to use a microscope before he could read. Born in Vienna in 1871, he made up his mind at five to become a doctor. Vienna has been his home and he has worked at the University almost continuously since graduation from the medical school in 1895. For five years following graduation, he worked in the University hospital on the wards studying the influence of the nervous system on various organs; even then he recognized the importance of the vegetative nervous system in contrast to voluntary innervation. For detailed study of the influence of the brain, he went to England in 1901 to study under Sir Charles Sherrington. A fellow student, Harvey Cushing, became one of his close friends.

The first description of the symptoms later to become known at the Froelich syndrome (*Dystrophia adiposogenitalis*) was given by Dr. Froelich in a paper presented to the Imperial Royal Vienna Society of Physicians in 1901. These symptoms, he believes, are the result of lesions or of a tumor-like growth in the gland area possibly exerting pressure on the hypothalamus, but not of any primary disturbance in the hypothalamus.

In 1902, ill health forced him to go to Italy for a year where he worked at the Marine Biological Station in Naples on the organs of equilibrium of the cephalopods. Here began his life-long interest in marine biology. On returning to Vienna, he decided to give up clinical work and devote himself to research. The University appointed him lecturer in experimental pathology and later (in 1912) professor of pharmacology and toxicology; he taught there until the Anschluss.

At Woods Hole, Dr. Froelich is carrying out work on the effects of drugs on heat narcosis which he believes will throw some light on the question of tissue permeability.

His chief non-scientific interest is music which he considers he inherited in some psychic way from living in the neighborhood of Beethoven's

home. He studied piano at the University and enjoys his key rôle in the Sunday night "music-ales" at the M. B. L. Club. He is fond of poetry and has contributed letters that he received from his friend, Rudyard Kipling to the Kipling Journal.

Dr. and Mrs. Froelich became American citizens in 1944. They plan to return to Cincinnati in September where Dr. Froelich has spent seven years working with Dr. Mirsky.

### SUPPORT OF THE NATIONAL SCIENCE FOUNDATION URGED

DR. HARRY GRUNDFEST

*National Secretary, American Association of  
Scientific Workers*

The bill to establish a National Science Foundation (S. 1850) passed the Senate by a two to one majority on July 3, with only one modification, which removed the Division of Social Sciences. The bill now goes to the House, where action during the next few weeks is essential if the National Science Foundation is to become a reality this year. Unfortunately, a complication was introduced into the House in the form of the Mills Bill, which attempts to revive the discarded Magnuson Bill. As pointed out in a series of recent articles in *Science*, the introduction of the Mills Bill (H. R. 6448) is dangerous because it may give the Congress the wrong impression that scientists are seriously divided on the question of the NSF. Actually, the overwhelming majority of scientists have expressed approval of the compromise bill worked out by Senators Magnuson and Kilgore with the aid of many scientists and after extensive hearings.

Since quick action in the House is necessary, it is urgent that workers in the MBL, who represent a cross section of biologists from the entire country take steps immediately on behalf of the National Science Foundation.

#### *What You Can Do*

1. Write or wire Representative J. Percy Priest, of Tennessee, (chairman of the subcommittee on the Science Bills) to report favorably on the Senate Bill and against the Mills Bill.

2. Write to your congressman to support the Senate Bill. You will find a list of all congressmen, by states and districts in the World Almanac, pp. 687 - 689 (in the library).

3. Write Congressmen John W. McCormack and Joseph W. Martin, House majority and minority leaders to bring the Senate Bill to the floor.

4. If you have friends or acquaintances among the congressmen please write them especially.

It is particularly important that scientists at Woods Hole take these actions because they can thereby influence congressmen from all parts of the country and from both parties, and thus aid greatly the future of all science.



(Continued from Page 1)

these phenomena. On the biological side the prospects are equally exciting. Presumably everything will be killed on a large sector of the reef. To study the repopulation of this natural surface should be extremely interesting.

What are the future prospects in oceanography? On the whole, they seem very bright indeed. The recent establishment at the Hydrographic Office of a Division of Oceanography will probably have much of the same effect as the establishment of the Weather Bureau had on meteorology. The government now has a headquarters for all oceanographic information and a means of organizing the oceanographic facilities in this country for large scale attacks on basic problems. One major difficulty with the earth sciences has been that individual investigators or even the private research organizations seldom have the resources to undertake a large scale observational program. It is the geographical aspects of oceanography that will in the end provide the means of solving many problems which will not yield to small scale studies. One ship operating alone in the North Atlantic cannot hope to learn very much about the current system. Only the government has the resources to deal effectively with such problems.

The recent Pacific Science Conference, called by the National Research Council, is also probably indicative of the future of oceanography. At this meeting plans were formulated for a simu-

ltaneous attack on all aspects of science in the central Pacific area. Although the Pacific Ocean is a long ways from Woods Hole, it is clear that we will not be immune from the proposed studies of this newly occupied area.

It seems advisable to end this brief report on a somewhat pessimistic note. Although there are obviously many interesting and useful things to be found out about the ocean, and a considerable number of qualified scientists have become interested in marine problems, progress will be slow unless additional research vessels are available. The greatly increased expenses of operating sea going vessels have become a severe drain on the resources of the private oceanographic laboratories.

The operation of *Atlantis*, for example, now would consume three quarters of our income from endowment. At the present time we are taking a long chance and installing a new engine which has been furnished by the government. Nevertheless, the shipyard bill, just for installing this engine, will approximate \$30,000. How can private oceanographic laboratories continue to operate in the face of such expenses? Obviously the temptation to accept government subsidy is overwhelming. Five years of experience in working with government funds convinces me that there is no real reason why university research people need have any fear of government control. Each needs the other in the worst possible way. As long as the civilian laboratory is effective, it will be able to dictate the local ground rules.

## NERVE AND MUSCLE SYMPOSIA OF THE NEW YORK ACADEMY OF SCIENCES

Two of the symposia organized by the New York Academy of Sciences during the last year were devoted to the problem of nerve and muscle physiology. By the presence of several distinguished guests from abroad the meetings had, for the first time after the war, an international character. Among the foreign guests was J. C. Eccles, professor at the University of Dunedin, New Zealand, who was for ten years closely associated with Sherrington in Oxford. Frederic Bremer, professor at the University of Brussels, also a former associate of Sherrington and of Harvey Cushing, was one of the chairmen of the nerve symposium. Among the scientists from France were Professor Brynard from the University of Toulouse, A. Fessard, from the College de France and R. Couteaux from the Sorbonne. Chinese physiologists were represented by Dr. Feng. The symposium was sponsored by the Rockefeller Foundation.

Biophysical and biochemical aspects of nerve function were equally stressed at the nerve symposium. Dr. Rudolph Hoerber lectured about the membrane theory, Detlev W. Bronk on chemical factors influencing nerve activity, Eccles presented

a new electric theory of the transmission of the nerve impulse in connection with his work on the end plate and synaptic potential. Drs. R. T. Cox and A. Fessard discussed work on the electric organs, Dr. David Nachmansohn, chairman of the symposium spoke on diolnesterase, Dr. A. Gilman, on the pharmacology of the nervous system and Dr. R. W. Gerard on metabolism and function.

At the muscle symposium the biochemical aspects were discussed by Drs. Otto Meyerhof and S. Ochoa. Dr. F. O. Schmitt presented most interesting new material on the ultra-structure. Drs. Alexander Sandow, E. Fischer and Dugal E. S. Brown lectured on different physical and physicochemical problems of muscle contraction. Observations on ions were analyzed by Dr. H. B. Stembach.

The presence of so many guests and old friends attracted a great crowd of outstanding nerve and muscle physiologists of this country. After the long interruption due to the war, the meetings offered the first opportunity for exchange of views and information about recent developments in the field.

## ITEMS OF INTEREST

DR. DETLEV W. BRON K, Johnson professor of biophysics and director of the Johnson Research Foundation at the University of Pennsylvania, has been appointed chairman of the National Research Council. He succeeds Dr. Ross G. Harrison who has retired after eight years in this position.

DR. DUGALD E. S. BROWN, professor of physiology, Dental School of New York University and trustee of the Marine Biological Laboratory has been appointed director of the Bermuda Biological Station. Dr. Brown took a plane to Bermuda early in July, but plans to return to the States for a brief period in August. He will come to Woods Hole to attend the meeting of the trustees.

DR. FRITZ LIPMANN, research chemist at the Massachusetts General Hospital, visited the MBL July 16 to 17. Dr. Lipmann, a former associate of Professor Otto Meyerhof, delivered a lecture on "Metabolic Energy Transformations" to the physiology class. He is an authority on energy transformations in the cell and is particularly known for his work on energy-phosphate bonds.

PROFESSOR CORNELIS BERNARDUS VAN NIEL, the former director of the Hopkins Marine Station in California and currently at the University of Stanford, engaged in some informal discussions of photosynthesis during his visit to the MBL the week-end of July 4th.

DR. JOHN MOORE, assistant professor of zoology at Barnard College, who has been teaching in the Embryology Course at the Laboratory this Summer, left on July 23 to join a collecting expedition from the American Museum of Natural History; the group leaves shortly for Northern and Central Mexico. The purpose of Dr. Moore's trip is to collect amphibians.

DR. EDWARD S. DEEVEY, limnologist at the Woods Hole Oceanographic Institution left last week to work with Dr. ARTHUR D. HASSLER of the University of Wisconsin. He will return to Yale University in September to his duties as assistant professor of biology.

ASHLEY H. CARTER, an electronic physicist, joined the staff of the Woods Hole Oceanographic Institution on July 8 as a research associate. He obtained his AB from Harvard last year and was a Naval communications officer until his recent discharge.

## THE EVENING LECTURES AND SEMINARS

Recent lectures have been: June 28: Dr. Jane Oppenheimer, "The Organization of the Telost Blastoderm". July 5: Prof. E. N. Harvey, "The Effects of High Velocity Missiles on Tissue". July 12: Dr. Benjamin W. Zweifach, "The Relation of Metabolic Derangements of Liver and Kid-

ney to Peripheral Vascular Reactions". July 19: Dr. E. W. Dempsey, "Observations on the Chemical Cytology of Several Manynalian Tissues". July 25: Dr. Howard Meyerhof, "The Crisis in Science Legislation".

The seminars were: July 9: Dr. Albert Tyler, "Inhibition of Fertilization in Sea Urchins by Means of Univalent Antibodies vs. Antifertilization"; Dr. W. A. Robbie, "The Cyanide Sensitivity of the Unfertilized Sea Urchin Egg"; Dr. J. E. Kindred, "The Effects of Mustard Vesicants on the Hemoletic Organs". July 16: Dr. A. F. Bliss, "Intermediate Steps in the Visual Cycle"; Dr. A. M. Shane, "The Role of Metabolism in the Injury Potential of Frog Nerves"; Dr. W. H. Price, "Adenosine, Triphosphatase, Myosine, Actin, and Their Relation to the Mechanico-chemical Coupling of Muscle". July 23: M. M. Brooks, "Oxidation-reduction Studies as a Clue to the Mechanism of Fertilization of Marine Eggs"; C. L. Yntema, "An Analysis of Induction of the Auditory Vesicle in the Salamander"; J. T. Bonner, "Aspects of Morphogenesis in the Slime Molds".

## THE SUNDAY MUSICALS

### An Appeal to Amateur or Professional Musicians

The Sunday musicals which have been a feature of the M. B. L. Club during the past two summers were instituted once more on July 7 with a short program of piano music and solo singing. The first evening was especially for the purpose of encouraging others to reveal their hidden talents that they might thus contribute to the general enjoyment of the attending audience.

This appeal, it is hoped, will uncover singers, whether men or women and instrumentalists from the piccolo-flute to the majestic double-bass. The capacities of the audience are manifold and their sympathetic attitude precludes harsh criticism.

If you are convinced that these musicals are contributing to the community life at the Laboratory or if you need additional encouragement, please contact either Dr. Alfred Frochlich (Br 311), otherwise known as "The Maestro," or Dr. Walter Wainio (Br 110).

## TENNIS AT M. B. L.

The mess court of the M. B. L. Tennis Club has been in use for some time due to the strenuous efforts of a few early comers to put it in shape. One of the beach courts is ready for use but the other needs more attention.

The club is a joint venture maintained by the dues and sweat of its members. Persons affiliated with the M. B. L. or with the W. H. O. I. and their families are eligible for membership. Dr. Ryan is secretary-treasurer of the organization.

# DIRECTORY FOR 1946

## KEY

### Laboratories

Botany Building.....	Bot	Old Main Building....	OM
Brick Building.....	Br	Rockefeller Bldg.....	Rock
Lecture Hall.....	L	Library.....	Lib

### Residences

Apartment.....	A	Kahler.....	Ka
David House.....	Da	Kidder.....	K
Dormitory.....	D	Nickerson.....	N
Drew House.....	Dr	Whitman.....	W
Fisheries Residence.....	F	Supply Dept. Bldg.....	S
Hubbard.....	H		

The place of residence is included only in the case of individuals living on laboratory property.

## MARINE BIOLOGICAL LABORATORY

### THE STAFF

#### ZOOLOGY

##### Consultants

Bissonnette, T. H. prof. biol. Trinity.  
Woodruff, L. L. prof. proto. Yale.

##### Instructors

Brown, F. A. Jr. assoc. prof. zool. Northwestern, in charge.  
Bullock, T. H. asst. prof. anat. Missouri Med.  
Burbanck, W. D. assoc. prof. biol. Drury.  
Goodchild, C. G. prof. biol. Southwest Missouri State.  
Lochhead, J. H. instr. zool. Vermont.  
Pierce, Madelene E. asst. prof. zool. Vassar.  
Reid, W. M. asst. prof. biol. Monmouth.  
Rogick, Mary D. prof. biol. New Rochelle.

##### Laboratory Assistant

Baca, Antoinette. Duke Med.

#### EMBRYOLOGY

##### Consultants

Armstrong, P. B. prof. anat. Syracuse Med.  
Goodrich, H. B. prof. biol. Wesleyan.

##### Instructors

Costello, D. P. prof. zool. North Carolina. in charge.  
Moore, J. A. instr. zool. Barnard.  
Oppenheimer, Jane M. asst. prof. biol. Bryn Mawr.  
Tyler, A. asst. prof. embr. California Inst. of Tech.

##### Research Assistant

Hopkins, Marjorie. California.

##### Laboratory Assistants

Henley, Catherine. Johns Hopkins.  
Lerner, Eleanor. Washington (St. Louis).

#### PHYSIOLOGY

##### Consultants

Amberson, W. R. prof. phys. Maryland Med.  
Bradley, H. C. prof. phys. chem. Wisconsin.  
Garrey, W. E. prof. phys. Vanderbilt Med.  
Jacobs, M. H. prof. phys. Pennsylvania.

## Instructors

Barron, E. S. G. assoc. prof. biochem. Chicago.  
Chase, A. M. asst. prof. biol. Princeton.  
Giese, A. C. assoc. prof. biol. Stanford.  
Kempston, R. T. prof. zool. Vassar.  
Parpart, A. K. assoc. prof. biol. Princeton. in charge.  
Ramsey, R. assoc. prof. phys. Virginia Med.

## BOTANY

### Consultants

Burkholder, P. R. Eaton prof. bot. Yale.  
Brooks, S. C. prof. zool. California.

### Instructors

Croasdale, Hannah T. Dartmouth.  
Doty, M. S. instr. bot. Northwestern.  
Taylor, W. R. prof. bot. Michigan, in charge.

## INVESTIGATORS

Abell, R. G. asst. prof. anatomy. Pennsylvania Med. Br 325.  
Abramsky, T. res. asst. Rockefeller Institute. Br 207. A 304.  
Addison, W. H. F. prof. hist. & emb. Pennsylvania Med. Br 344. A 108.  
Amberson, W. R. prof. phys. Maryland Med. Br 302.  
Anderson, R. S. asst. prof. phys. Maryland Med. Br 342. F 42.  
Anfinson, C. B. associate biochem. Harvard Med. Br 216. A 308-9.  
Armstrong, P. B. prof. anat. Syracuse Med. Br 318. A 301.  
Baitsell, G. A. prof. biol. Yale.  
Baker, Gladys E. assoc. prof. bot. Vassar. Lib U.  
Ball, E. G. prof. biol. chem. Harvard Med. Br 313.  
Barron, E. S. G. assoc. prof. biochem. Chicago Med. OM 1B.  
Bender, A. invest. phys. Pennsylvania. Br 219I, D 210.  
Bennihof, C. L. asst. prof. biol. Western Maryland. (July 23).  
Berger, C. A. dir. Bio. Lab. (Fordham) Br 225.  
Berman, Marjorie res. asst. neurol. Columbia. Br 336.  
Bevelander, G. assoc. prof. anat. New York. Br 110. F 41.  
Bliss, A. F. instr. phys. Tufts Med. Br 122. A 105.  
Block, R. asst. prof. Yale. Lib Q.  
Blum, H. F. Guggenheim fel. phys. Lib. 7. N 7 & 9.  
Boell, E. J. assoc. prof. biol. Yale. (July 15).  
Bonner, J. T. Junior fel. biol. Harvard. Br 217K. A 102.  
Bridgman, Josephine assoc. prof. biol. Limestone College, North Carolina.  
Brink, F. Jr. res. assoc. Pennsylvania. Br 317.  
Bronk, D. W.  
Brooks, S. C. prof. zool. California. Br 320.  
Brooks, Matilda M. res. assoc. biol. California. Br 320.  
Brounell, Katherine A. res. assoc. phys. Ohio State. Br 111. A 305.  
Brown, F. A., Jr. prof. zool. Northwestern. OM 28. A 202.  
Brust, M. teach. fel. biol. New York. Bot 5. K 15.  
Buck, J. B. Nat. Inst. of Health. Br 329.  
Buddington, R. A. emerit. prof. zool. Oberlin. Br 218.



- Bullock, T. H. asst. prof. anat. Missouri. Br 335 OM 24. D 311.
- Burbank, W. D. prof. biol. Drury. OM 27. D 302.
- Burkholder, P. R. prof. bot. Yale. Br 106.
- Campbell, Margaret T. res. asst. embr. California Inst. Tech. Br 233.
- Cannan, R. K. prof. chem. New York. Br 309.
- Cantoni, G. L. asst. prof. phys. & pharm. Long Island Med. (Aug. 4).
- Cassidy, H. G. asst. prof. chem. Yale. Lib 3. D 213.
- Chambers, R. prof. biol. New York. Br 325.
- Chamber, E. OM.
- Chase, A. M. asst. prof. biol. Princeton. OM 2.
- Cheney, R. H. chairman biol. Long Island. (July 29).
- Chrystall, Frieda L. teach. biol. Julia Richmond High (N.Y.)
- Claff, C. L. res. fel. surg. Harvard Med. Br 216. A 208-9.
- Clark, E. R. prof. anat. Pennsylvania Med. Br 117.
- Clement, A. C. assoc. prof. biol. Charleston. Br 217. Da 103.
- Cole, K. S. prof. biophysics. Chicago. Br 332. D 1.
- Conklin, E. G. emerit. prof. biol. Princeton. Br 321.
- Copeland, D. E. asst. prof. zool. Brown. Rock 3. D 314.
- Costello, D. P. prof. zool. North Carolina. Br 123. A 201.
- Cox, E. H. prof. chem. Swarthmore. (Aug. 16).
- Croasdale, Hannah T. tech. asst. bot. Dartmouth. Bot. Crouse, Helen V. res. assoc. Pennsylvania. Br 204.
- Crowell, S. assoc. prof. zool. Miami. Br 217M.
- Curtis, W. C. prof. zool. Missouri. Br 331. D 212.
- Dalton, H. C. instr. biol. Brown. (Aug. 5).
- Deane, Helen W. anat. Harvard Med. Br 217B.
- DeFalco, Rose H. res. asst. zool. Pennsylvania. Br 204.
- Dietz, Alma. asst. t. head. biol. American International College (Mass.) Bot W.
- Diller, Irene C. res. cytol. Lankenau Hospital. OM 43.
- Diller, W.F. asst. prof. Pennsylvania. OM 43.
- Doty, M. S. instr. bot. Northwestern. Bot. A 303.
- Douglas, Marjorie B. asst. zool. Chicago. OM 36.
- Dumm, Mary E. instr. chem. New York Med. Br 309.
- Ellinger, T. U. H. prof. zool. Howard. Rock 6. Dr. 5 & 8.
- Erdman, J. G. fel. biochem. Mellon Inst. of Indus. Res. (Aug. 11).
- Failla, G. prof. radiol. Columbia. Br 306. D 210-11.
- Figge, F. H. J. assoc. prof. anat. Maryland Med. Br 315.
- Fisk, A. A. fel. path. Yale Med. Br 217F.
- Fiske, Virginia M. instr. zool. Wellesley. Br 217D.
- Fox, Marjorie H. res. fel. zool. California. Br 314.
- Friedmann, U. head bact. Jewish Hospital, (Brooklyn, N.Y.) (July 15).
- Fries, E. F. B. asst. prof. biol. City Col. (N.Y.) Br 217L.
- Frisch, J. A. prof. biol. Canisius (Buffalo). OM 44.
- Fröehlich, A. assoc. neurol. May Inst. (Cincinnati). Br 311. Da 6.
- Furth, J. prof. path. Cornell Med. Bot 2.
- Garrey, W. E. emerit. prof. phys. Vanderbilt. Br 215.
- Giese, A. C. prof. biol. Stanford. OM 1A. D 311.
- Gilbert, P. W. asst. prof. zool. Cornell. (Aug. 1).
- Gilman, Lauren C. asst. prof. zool. South Dakota. Br 217H.
- Goreau, T. F. med. Pennsylvania. Br 2170.
- Gorechild, C. G. prof. biol. Missouri. OM 29.
- Gould, Eleanor S. asst. anat. Tulane Med. (Aug. 1).
- Gould, H. N. prof. biol. Tulane. (Aug. 1).
- Grand, C. G. res. asst. biol. New York. Br 325.
- Grant, Madeleine P. memb. faculty zool. Sarah Lawrence. Br 303.
- Gray, I. E. prof. zool. Duke. Br 125.
- Green, J. W. grad. biol. Princeton. OM Base.
- Greenstein, J. P. principal biochemist. National Cancer Institute. (Aug. 1).
- Greenberg, R. grad. Ohio. Br 122. Dr 1.
- Gregg, J. R. instr. biol. Johns Hopkins. Br 216.
- Grundfest, H. res. assoc. neurol. Columbia. Med. Br 126.
- Gudernatsch, F. visit. prof. biol. New York.
- Gurevich, V. asst. visit. physician. Bellevue Hospital. Lib. K.
- Hamilton, H. L. asst. prof. zool. Iowa State. OM 39. Dr 6.
- Harding, C. V. Jr. asst. phys. Brown. Br 227.
- Hanrily, M. H. assoc. prof. biol. New York. Br 343.
- Hartman, F. A. prof. phys. Ohio. Br 111. D 218.
- Harvey, Ethel B. invest. biol. Princeton. Br 116.
- Harvey, E. N. prof. phys. Princeton. Br 116.
- Haywood, Charlotte. prof. phys. Mount Holyoke. Br 340.
- Heilbrunn, L. V. prof. zool. Pennsylvania. Br 219.
- Helfman, Myra. res. asst. biol. New York. Br 110.
- Henley, Catherine. instr. biol. Johns Hopkins. OM 41. K 12.
- Hibbard, Hope. prof. zool. Oberlin. Br 218.
- Hopkins, H. S. assoc. prof. phys. New York Dent. OM 39. A 107.
- Hopkins, C. Nadine. asst. zool. Northwestern.
- Honegger, Carol. instr. biol. Temple. Br 214. D 216.
- Hutchings, Lois M. instr. biol. New York. Br 315.
- Hunter, F. R. asst. prof. zool. Oklahoma. OM.
- Ifft, J. D. asst. prof. biol. Simmons. OM 36. D 310.
- Jacobs, M. H. prof. phys. Pennsylvania. Br 205.
- Jenkins, G. B. emerit. prof. anat. George Washington Med. OM 46.
- Johlin, J. M. assoc. prof. biochem. Vanderbilt Med. Br 122D. D 212.
- Kaan, Helen W. assoc. prof. zool. Wellesley. A 206.
- Keller, R. res. Robinson Found. (N.Y.) OM 45.
- Kemp, Margaret asst. prof. bot. Smith. A 204.
- Kerschner, Jean. res. asst. zool. Pennsylvania. Br 204.
- Kindred, J. E. prof. anat. Virginia Med. Br 122A. D 208.
- Kleinholz, L. H. Guggenheim fel. biol. Harvard. Br 121.
- Klotz, I. M. asst. prof. chem. Northwestern. OM 28.
- Klotz, J. W. instr. biol. Concordia. (Ill.) Rock 7.
- Krasnow, Frances head res. Guggenheim Dental Found. Lib D.
- Kreiger, G. L. Guggenheim fel. phys. Princeton Br 321.
- Krugelis, Edith J. instr. zool. Vassar. (Aug. 1).
- Kuntz, Eloise asst. Brown. OM 36. D 307.
- Lavin, G. I. Rockefeller Inst. Br 231.
- Lazarow, A. asst. prof. anat. Western Reserve Med. Br 107.
- Le Fevre, Linda. res. asst. Pennsylvania. Rock 7.
- Le Fevre, P. G. instr. phys. Vermont Med. Br 227.
- Lein, J. grad. biol. Princeton. OM Base.
- Lerner, Eleanor fel. zool. Washington (St. Louis). OM 41. H 8.
- Lillie, R. S. prof. phys. Chicago. Br 326.
- Lilly, D. M. asst. prof. biol. St. John's (Brooklyn). Bot. 4.
- Llana, A. H. asst. dir. bot. Marine Biol. Sta. (Chile). Bot. 1.

- Lochhead, J. H. asst. prof. zool. Vermont. OM 34. D 204-5.
- Loewi, O. res. prof. pharm. New York Med. Br 311.
- Lovelace, Roberta. tech. fel. zool. North Carolina. Br 217G.
- Low, Eva M. grad. chem. Yale. Lib E.
- Lowell, Lowell, res. asst. New York. Br 110. D 309.
- Lucké, B. prof. path. Pennsylvania Med. Br 223.
- Lynch, W. F. tech. fel. New York.
- McDonald, Sister Elizabeth Seton. prof. biol. Mount St. Joseph-on-the-Ohio. (Cincinnati). Lib A.
- McLean, Dorothy J. dem. zool. Toronto. Br 315. D 215.
- Marinelli, L. D. physicist. Memorial Hospital.
- Marmont, G. H. asst. prof. phys. Chicago. Br 332.
- Marsland, D. assoc. prof. biol. New York. Br 343. D 112B.
- Mast, S. O. emerit. prof. zool. Johns Hopkins. Br 329.
- Menkin, V. asst. prof. path. Duke Med. OM 45.
- Metz, C. W. prof. zool. Pennsylvania. Br 204.
- Mitchell, Constance. res. asst. zool. Pennsylvania Rock 7. W.
- Mitchell, P. H. prof. phys. Brown.
- Mitchell, R. F. res. asst. biol. New York. Br 325.
- Moore, J. A. asst. prof. zool. Barnard. Br 339. Dr 7.
- Moscowitz, E. asst. prof. chem. med. Columbia.
- Moul, E. teach. fel. bot. Pennsylvania. Bot. 1. D 201B.
- Nachmansohn, D. res. assoc. neurol. Columbia Med. Br 335-6. D 112B.
- Nelson, L. invest. Br 217F. Da 10.
- Norris, K. H. asst. electronic eng. Chicago. Br 332.
- Northrup, J. H. mem. phys. Rockefeller Inst. Br 209.
- Oppenheimer, Jane M. asst. prof. biol. Bryn Mawr. Br 322. D 308.
- Ormsbee, R. A. assoc. Memorial Hosp. Br 312.
- Orr, P. R. asst. prof. biol. Brooklyn.
- Oster, R. H. assoc. prof. phys. Maryland Med. Br 342.
- Osterhout, W. J. V. mem. Rockefeller Inst. Br 207. A 203.
- Parpart, A. K. prof. biol. Princeton. OM 2.
- Pierce, Madeleine F. assoc. prof. zool. Vassar. OM 26. D 316.
- Pierson, Bernice F. invest. Johns Hopkins. Br 315.
- Ponder, E. invest. Nassau Hospital. (Mineola).
- Pulsdon, D. F. asst. prof. biol. Yale. (Aug. 1).
- Price, W. H. res. asst. pharm. Washington Med. (St. Louis). Br 108.
- Rakestraw, N. W. res. assoc. chem. oceanography. Woods Hole Oceanographic Inst. Br 310.
- Rall, W. grad. biophys. Chicago. Br 332.
- Ramsey, R. assoc. prof. phys. OM 4.
- Rankin, J. S. Jr. asst. prof. zool. Connecticut.
- Reid, W. M. head biol. Monmouth (Ill.) OM 32.
- Reinhard, E. G. prof. biol. Catholic University. Br 330. D 202.
- Robbie, W. A. res. asst. prof. ophthalm. and phys. Iowa. Br 213. D 111. (Unit. State July 15).
- Rogers, H. C. Deerfield Academy (Mass.) OM 36.
- Rogick, Mary D. prof. biol. New Rochelle. OM 25.
- Rosen, Gloria. res. asst. bact. Yale. Br 100.
- Rothenberg, M. A. res. asst. biochem. Columbia. Br 336.
- Ryan, F. J. asst. prof. zool. Columbia. Br 305.
- Sandeen, M. asst. zool. Northwestern.
- Sandow, A. asst. prof. biol. New York. (Aug. 5).
- Savage, J. L. Rockefeller fel. math. Columbia. Lib M. N 9.
- Schaeffer, A. A. prof. biol. Temple. Br 214. D 313.
- Scharrer, E. assoc. prof. anat. Colorado Med. Br 107.
- Scharrer, Berta. instr. anat. Colorado Med. Br 107.
- Schneyer, L. instr. phys. New York. Br 110. D 207.
- Schrank, A. R. asst. prof. phys. Texas.
- Scott, Sister Florence M. prof. biol. Seton Hill (Pa.) Br 225.
- Scott, G. T. asst. prof. zool. Oberlin. Br 218.
- Serin, B. G. res. asst. zool. Pennsylvania. Rock.
- Shanes, A. M. asst. prof. phys. New York. Br 110. D 101B.
- Shereshfetsky, J. L. prof. physical chem. Howard. Rock 6. Da 9.
- Sichel, F. prof. phys. Vermont Med. Br 318.
- Slifer, Eleanor H. asst. prof. Iowa State. Br 217A. D 203.
- Smith, J. instr. biol. Columbia. Br 422. D 49.
- Speidel, C. C. prof. anat. Virginia. D 315.
- Steinbach, H. B. assoc. prof. zool. Washington (St. Louis). Br 108.
- Stern, K. G. adj. prof. biochem. Polytech. Inst. (Brooklyn).
- Stewart, Dorothy R. res. assoc. phys. Pennsylvania. Br 205. D 49.
- Stokey, Alma G. prof. Mount Holyoke. Bot A.
- Straus, W. L. Jr. assoc. prof. anat. Johns Hopkins. OM 23. Dr.
- Taylor, Babette. grad. zool. Washington (St. Louis). Br 108. K 8.
- Te Winkel, Lois E. assoc. prof. zool. Smith. Br 217B. A 205.
- Thomson, Betty F. asst. prof. bot. Connecticut Col. for Women. Br 321.
- Tracy, H. C. prof. anat. Kansas. Br 118. F 53.
- Tyler, A. assoc. prof. emb. California Inst. of Tech. Br 233.
- Tyler, Betty S. res. asst. emb. Cal. Inst. of Tech. Br 233. D 206.
- Ulled, E. res. asst. biol. Temple Med. OM 45.
- Villee, C. A. instr. biol. chem. Harvard Med. Br 313. A 106.
- Vishniac, W. res. asst. zool. Washington (St. Louis). Br 108. Dr. attic.
- Wainio, W. W. asst. prof. phys. New York. Br 110.
- Warner, R. C. asst. prof. chem. New York. Br 309.
- Watts, Nellie P. res. assoc. therap. New York. (Aug. 5).
- Weiss, P. prof. zool. Chicago. (July 15).
- Weiss, M. S. teach. fel. biol. New York. Bot. 6. K 15.
- Wheeler, C. H. Jr. instr. phys. Kansas. Br 118.
- White, Elizabeth L. grad. biol. Bryn Mawr. Br 217E. K 12.
- Whiting, Anna R. instr. zool. Pennsylvania. Rock 7.
- Whiting, P. W. prof. zool. Pennsylvania. Rock 7.
- Wichterman, R. assoc. prof. biol. Temple. Br 122C. D 104.
- Wiercinski, F. J. prof. biol. Lewis Sch. (Chicago). Br 217N.
- Wilber, C. G. asst. prof. phys. Fordham. Br 226. D 108.
- Willier, B. H. prof. biol. Johns Hopkins. Br 324. D 301A.
- Willis, Marian. res. asst. zool. Pennsylvania. Br 219.
- Wilson, Jean E. grad. zool. Pennsylvania. Br 220. Da 10.
- Wilson, T. H. phys. Pennsylvania Med. Br 205.
- Wilson, W. L. grad. radiology. Pennsylvania. Br 219. Da 10.
- Winsor, C. P. asst. prof. Johns Hopkins.
- Woodward, A. A. Jr. res. asst. zool. Pennsylvania. Br 220. D 301B.
- Wrinch, Dorothy. lect. phys. Smith. Br 223.
- Yntema, C. L. asst. prof. anat. Cornell. Br 301.
- Zacks, S. res. asst. hist. Brookline High. Br 344.

- Ziegler, Bernice. grad. asst. zool. Washington (St. Louis). Br 108. K 2.  
 Zorzoli, Anita. instr. phys. Washington (St. Louis). Lib B. H 9.

## STUDENTS

- Abajian, J. Jr. assoc. prof. anesthesiology. Vermont Med. phys.  
 Banner, A. H. asst. prof. zool. Hawaii (Honolulu). embr. F 55.  
 Barish, Natalie. Goucher. embr. H 3.  
 Benedict, Dora. Harvard Med. phys. W b.  
 Berg, G. G. grad. zool. Columbia. phys. Ka 24.  
 Brinsley, B. grad. New York. embr. F 47.  
 Bruch, P. R. Wesleyan (Conn.) embr. K 6.  
 Bucklin, D. H. grad. Brown. embr. F 55.  
 Chivers, Miriam. grad. Howard. embr. Dr 10.  
 Clark, C. C. grad. asst. Columbia. phys. K 5.  
 Connelly, C. M. grad. cancer fel. Pennsylvania. phys. Ka 23.  
 Crapster, W. P. phys. F 54.  
 DiDea, A. grad. asst. zool. Washington (St. Louis). embr. K 7.  
 Ebert, J. D. grad. embr. Johns Hopkins. embr. D 107.  
 Eisenberg, Norma. grad. embr. Brooklyn. embr. K 1.  
 Fitch, Naomi, S. McGill. embr. W c.  
 Flood, F. X. asst. prof. biol. Canisius (Buffalo) embr. Friedman, F. L. grad. phys. Brooklyn. embr. K 1.  
 Galbreath, Jean L. asst. biol. Elmira. embr. H 7.  
 Gregg, J. H. grad. Miami Marine Lab. phys.  
 Gregory, J. C. grad. organ. chem. Yale. phys. K 7.  
 Guthe, K. F. grad. biol. Harvard. phys.  
 Harrison, J. W. grad. biol. Washington and Jefferson. embr. F 48.  
 Harting, Janey. asst. Washington (St. Louis) phys. K 3.  
 Hunter, F. R. asst. prof. zool. Oklahoma. phys. Ka 24.  
 Joftis, D. L. grad. Tufts. phys. F 49.  
 Johnson, Shirley A. res. asst. gen. phys. Toronto. phys. D 215.  
 Jones, Alberta. grad. embr. Howard. embr. Dr 10.  
 Kemp, N. E. instr. biol. Wayne. phys.  
 Kuff, E. L. grad. Johns Hopkins. embr. K.  
 Leigh, W. H. instr. zool. Chicago City Jr. College. embr. F 47.  
 Levin, Ilene B. grad. Goucher. phys. H 1.  
 Liu, Chien-Kang. grad. zool. McGill. embr. F 44.  
 Markert, C. L. grad. asst. zool. Johns Hopkins. embr. F 45.  
 Marshall, Jean McE. instr. phys. Mount Holyoke. phys.  
 McPhee, Gwelda S. grad. asst. phys. Vassar. phys. H 2.  
 Mendes, E. G. asst. prof. S. Paulo (Brazil). phys. Dr 3.  
 Moore, Ellen L. Wellesley. embr. W p.  
 Morris, D. M. Jr. grad. asst. zool. Indiana. embr.  
 Mullally, W. B. instr. biol. St. Anselm (N. H.) embr.  
 Murland, R. L. grad. biol. Washington & Jefferson. embr. F 48.  
 Narahara, H. T. grad. Columbia. phys. K 14.  
 Nelson, T. C. grad. asst. zool. Columbia. phys. A 104.  
 Pequegnat, W. E. asst. prof. zool. Pomona (Calif.) embr. F 45.  
 Roys, C. C. grad. Chicago. phys. F 50.  
 Saslow, H. B. lab. instr. and grad. Illinois. phys. F 54.  
 Schecter, D. E. grad. McGill. embr. F 44.  
 Seaman, Arlene. instr. zool. Cornell. embr. W e.  
 Shapiro, Esther M. Goucher. embr. H 1.  
 Shulman, N. R. Johns Hopkins Med. phys. F 50.  
 Silber, E. Maryland Med. phys. F 50.  
 St. George, R. C. C. Jr. grad. chem. Harvard. phys.  
 Tatum, Anne. grad. Rosemont College. embr. W e.  
 Tiemeier, O. W. grad. fel. zool. Illinois. embr. F 45.  
 Tuttle, Ruth F. instr. Carnegie Inst. embr. W c.  
 Uber, Virginia M. asst. biol. Penn. College for Women. embr. W i.  
 Umbarger, H. E. grad. phys.  
 Wilson, M. E. grad. bot. Western Maryland College. H 2.

## OFFICE OF ADMINISTRATION

- Archibald, Ruth M. sec. W.  
 Crowell, Polly L. asst. to bus. mgr.  
 Myers, Lila S. sec.  
 MacNaught, F. M. bus mgr.  
 Packard, C. director.  
 Tuthill, Elizabeth, L. sec.

## EXPERIMENTAL RADIOLOGY

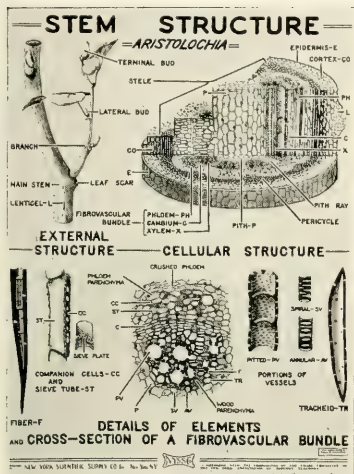
- Failla, G. Columbia Med.  
 Hyde, L. R. Phillips. Exeter.

## THE SUPPLY DEPT

- Abbott, T. Episcopal Acad. (Philadelphia). collector.  
 Beal, T. P. Brooks School. collector. Ka.  
 Crowell, Ruth S. sec.  
 Dietz, Alma. Amer. Internat'l. College. botany. collector W.  
 Goffin, R. collector.  
 Graham, J. Haddonfield High. collector.  
 Gray, M. B. collector.  
 Hilton, A. M. collector.  
 Kahler, W. E. collector.  
 Lahive, Joanne F. sec. W.  
 Lely, G. collector.  
 Marie, R. Boston English High. collector. Ka.  
 McInnis, J. mgr.  
 Parrish, N. collector. Ka.  
 Rankin, J. Connecticut. preparator. Dr.  
 Sellin, T. Germantown Friends. collector. Ka.  
 Siegel, R. Connecticut. collector. Ka.  
 Wamsley, F. W. supervisor of schools (Charleston) preparator.  
 Whitman, E. N. collector.  
 Zinn, D. J. naturalist.

NOTE: Limitations of space prevents the inclusion of the names of persons classified under the following heads: Apparatus, Chemical, Glassblowing, Optical Laboratory, Photographic, The Biological Bulletin and Museum. They will be printed in the next issue.





## NYSSCO CHART

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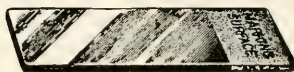


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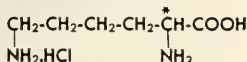
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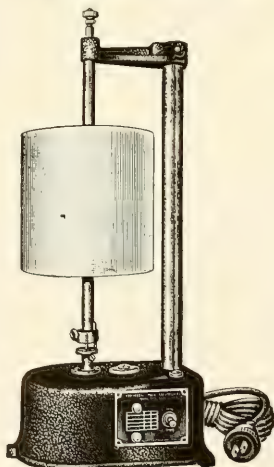
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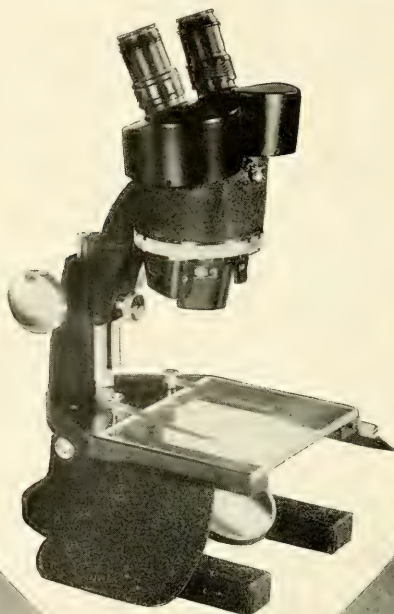



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SATURDAY, AUGUST 3, 1946

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## THE BERMUDA BIOLOGICAL STATION FOR RESEARCH

DR. DOUGLAS MARSLAND  
*Associate Professor of Biology,  
New York University*

The work of the Bermuda Biological Station came to a standstill during the war when the American Air Corps took over the entire plant for use as a hospital. But now the research program of the station is reviving under the leadership of the new director, Dr. Dugald E. S. Brown; this report represents the impressions of the first investigator to visit the station in the post-war period.

The Bermuda Station promises to become an internationally important research center for work in biology and oceanography. The islands are favored by many natural advantages and, in fact, a committee of the National Academy of Sciences in 1928 selected Bermuda as an ideal location for biological and oceanographic work, summarizing their recommendations in the following manner:

"(1) It's (the Bermuda volcanic cone) slopes  
(Continued on Page 35)

## THE EFFECT OF HIGH VELOCITY MISSILES ON TISSUES\*

DR. E. NEWTON HARVEY  
*Professor of Physiology,  
Princeton University*

It was observed during World War II that steel splinters from bomb bursts, passing through human tissue, often caused terrific damage at a very considerable distance from the path. Extensive damage is always associated with such high velocity missiles. Bones may be broken even though they are not hit, nerves lose irritability with no outward sign of damage and small blood vessels are torn in a large area around the missile track.

In order to understand the mechanism of such damage the Committee on Medical Research of the Office of Scientific Research and Development requested a study of such effects. This study was carried out at Princeton University by myself and a large group of workers including

Drs. E. G. Butler, J. H. McMillen, W. O. Puckett, H. Grundfest, I. M. Korr, G. Oster, W. D. McElroy, A. H. Whiteley, W. Kleinberg and additional technical assistants. The study can be called

### M. B. L. Calendar

**FRIDAY, August 9, 8:00 P.M.**

**Lecture:** Dr. Eric G. Ball; Biochemical Studies on the Malarial Parasite.

**TUESDAY, August 13, 8:00 P.M.**

**Seminar:** Dr. Katherine A. Brownell: Evidence for a New Factor from the Adrenal.

Dr. F. A. Hartman: Hyperactivity of the Adrenal Cortex.

Dr. D. A. Lazarow: Studies on the Mechanism of Production of Diabetes with Alloxan.

Dr. Dorothy Wrinch: On the Nature of Biological Specificity.

**FRIDAY, August 16, 8:00 P.M.**

**Lecture:** Dr. M. H. Jacobs: Cell Membranes, Cell Permeability and Cell Volume.

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# THE BOTANY CLASS

Back row: Hannah Crossdale, Dr. S. C. Brooks, Dr. M. S. Doty, Dr. Margaret Kemp. Middle row: Mary Fahey, Justine Carnic, Mary Keefe, Betty Urquhart, Dr. Alma Stokey, Dr. P. Burkholder, Anna Torrey, W. Vismac, Marie Wilson. Front row: Sister Adele Clifford, Dr. W. J. V. Osterhout, Alma Dietz, Janet Fraas.

*Wound Ballistics* and is designed to give the surgeon a first hand knowledge of the formation of a wound in order that a logical treatment can be undertaken.

Since all the damage from a high velocity missile is over in a few thousandths of a second, the investigation required the application of new biophysical methods and was in large part made on non-living models which imitated the material of tissues.

The human body is mostly water and the behavior of a missile in any soft part of the body (excluding bone, cartilage, tendon and skin) is quite analogous to that in water. The law which determines the slowing of a missile in water, its retardation, also holds for soft tissues although the numerical value of the constants may differ. Since water is a clear medium, it is admirably suited to photographic methods and fundamental laws can be established with great ease and accuracy. The newer techniques of high speed moving pictures (2,000 to 8,000 frames a second) and microsecond exposure photographs clearly reveal the various phenomena in water or other transparent media such as gelatin gel. The final proof of similarity of behavior in water or gelatin on the one hand, and in soft tissues of the body on the other, comes from microsecond roentgenograms. This remarkable development, perfected just before the war, allows a roentgenogram to be taken with a one-millionth second exposure. When it is used with a reliable trigger device, a bullet can be radiographed at any point in its path through opaque tissues and the accompanying changes recorded. The penetration of bone has been studied but our discussion will be limited to the mechanism of wounding in watery tissues since bone presents a quite separate problem.

When a high velocity steel sphere hits a surface of water, gel or tissue, the momentary pressure at the front is enormous. The liquid is compressed and this region of compression moves out from the point of impact as a shock wave. Since the velocity of the shock wave is that of sound in water (4,800 feet—1,440 meters—per second), it rapidly progresses ahead of the steel sphere now retarded by the water. Thus the first event in penetration of a bullet is similar to that in an underwater explosion in which shock waves likewise form.

As the sphere progresses farther and farther it expends its remaining energy in accelerating the medium which is pushed sideways as well as forward thereby leaving a conical cavity in its wake. At a certain point in the path the conical cavity separates from the sphere, constricts and changes shape, repeating the expansion and contraction several times. The cavity finally resolves itself

into a mass of small air bubbles which rise to the surface of the water.

This behavior is exactly comparable to that which occurs in tissue. If a shot is fired through the thigh of a deeply anesthetized cat or dog, high speed moving pictures reveal the large temporary swelling under the skin with the subsequent series of pulsations and the return to normal size in a few hundredths of a second.

Superficially, not much damage appears to have occurred but anatomic examination shows a permanent cavity filled with blood and tissue debris in the path of the missile and a surrounding region in which small vessels have broken and blood has extravasated into tissue spaces. The two areas are readily seen as a cavity and a dark region in cross sections normal to the path of the missile. Histologic examination reveals damage to muscle in a region near the permanent cavity but farther out, breaking of capillaries only and no visible damage to muscle fibers which remain intact. A bone may be fractured at some distance from the path of the missile.

High speed photography of a leg reveals only the external changes and what goes on inside must be inferred from analogous shots into water or gelatin. That these inferences are correct and that the changes in a leg or the abdomen are exactly similar to those in water can be established by a series of the microsecond roentgenograms referred to previously.

Such microsecond roentgenograms show clearly the large temporary cavity and reveal the breaking of bone by the pressure of tissue moving outward in all directions as the cavity expands. They also show the stretching of blood vessels and of nerves, likewise by the radial movement of tissue at the surface of the temporary cavity. The overstretching of the nerve fibers injures them although the nerve trunk as a whole is elastic enough to prevent a break. No external evidence of damage can be found in such a paralyzed nerve.

Although high pressures accompany the shock wave previously mentioned and pressure changes result from pulsation of the temporary cavity behind the missile, such changes do not appear to injure tissue unless gas is present.

In regions of a gas pocket (in intestine or lung) pressure changes cause contraction or expansion of the gas and such movement then injures tissue. The gas pocket behaves like a secondary cavity and the stretch of tissue around it is highly destructive. Similar changes occur in underwater explosions and the destructive effect of an explosion on fish is probably connected with the presence of a gas-filled swim bladder in these forms.

The quantitative study of wound ballistics allows us to predict exactly how much tissue

damage will result from a given mass moving with a known velocity and explains in a logical manner the various observations on wounds made in the field.

## EGG AND SPERM EXTRACTS AND FERTILIZATION<sup>1</sup>

DR. ALBERT TYLER

*Associate Professor of Embryology California Institute of Technology, Pasadena*

From eggs and sperm of marine animals there have been obtained four specific interacting substances which have been termed fertilizin (from eggs), antifertilizin (from sperm), egg-membrane-lysin (from sperm) and antifertilizin (from eggs). Fertilizin, which agglutinates species sperm, was first adequately described by F. R. Lillie (1913) who, together with E. E. Just, in an extensive series of investigations provided strong evidence that it was concerned in the fertilization process. Fertilizin has been purified and its properties and distribution in the animal kingdom further examined. In sea-urchins it is found to be a highly acidic protein of low nitrogen content and with some polysaccharide evidently present. In some species of animals it has been shown to occur in a non-agglutinating form. In one such case it has been possible by special treatment to enable it to agglutinate sperm. Antifertilizin has been extracted from sperm and purified. It is a protein of relatively low molecular weight, isoelectric at pH 3. Lillie applied serological concept and terminology to the interaction of these substances and this point of view receives further support in the more recent work. Sperm extracts and body-fluids of invertebrates also exhibit heteroagglutinating action of broad specificity which is evidently distinct from the isoagglutination reactions. The egg-membrane-lysin is a protein of greater heat lability than the others and is analogous in its action to lytic agents found in sperm of amphibia and of mammals. In sea-urchins too, an agent of lytic surface action has recently been described. The antifertilizin from eggs, originally postulated by Lillie, has been extracted from eggs and exhibits an agglutinating action on intact eggs similar to that shown by antifertilizin from sperm. The finding of this substance furnishes a basis for an auto-antibody theory of cell structure and growth.

It is the role of these substances in the fertilization process with which we are primarily concerned. Fertilizin, which in the sea-urchin forms the gelatinous coat of the egg, has been found to serve as an aid to fertilization. However, when it is present in excess in the solution it blocks fertilization, presumably because the reaction with sperm occurs apart from the surface of the egg.

\*The work described in this paper was done under contract, recommended by the Committee on Medical Research, between the Office of Scientific Research and Development and Princeton University.

Whether or not fertilizin is entirely essential for fertilization can not as yet be stated inasmuch as it is quite possible that some fertilizin remains on the surface of the egg after the treatments employed for its extraction. For antifertilizin, evidence of its importance in the fertilization reaction has been obtained by partially extracting it from sperm at pH 5 to 5.5, whereupon the fertilizing power of the spermatozoa is greatly reduced with little effect on their rate of oxygen consumption or motility. For the egg-membrane-lysin, the manifest action on membrane barriers implies that it is instrumental in enabling the spermatozoa to enter the egg, but no direct tests of this have as yet been made. In rabbits, the analogous hyaluronidase has been found to be effective in replacing to a great extent the surplus of sperm required for successful fertilization upon artificial insemination. The antifertilizin from eggs was supposed, according to Lillie's theory, to interact with fertilizin upon contact of egg and sperm and to be thereupon involved in the activation of the egg and the establishment of the block to polyspermy. While Lillie's famous fertilizin theory continues to receive support in the more recent work, this latter point still needs to be experimentally demonstrated.

In order to obtain further information on the role of these substances in fertilization, antisera were prepared against them by the immunization of rabbits. Fertilizin and the two anti-fertilizins were found to be active antigens, capable of eliciting the formation of antibodies that give good precipitin reactions with the solutions of these antigens. The antibodies against antifertilizin also agglutinate the species sperm. This holds whether the antifertilizin from sperm or that from eggs is employed as the immunizing antigen. Although the antibodies against the antifertilizin from eggs agglutinate sperm they do not agglutinate the intact eggs. This apparent paradox is understandable since the antigen in this case is located below the surface coat. Tests were made of the action of the antisera produced against the antifertilizin of sperm on the fertilizing power of the sperm.

<sup>1</sup> Based on seminar reports given at the Marine Biological Laboratory on July 8 and 9.



Since the ordinary antisera agglutinate sperm it is evident that any interference with fertilization could be attributable to the mechanical tying up of the sperm and would supply no information concerning possible specific action. It has been found, however, that antibodies can be readily converted by photo-oxidation into a non-agglutinating form, termed "univalent," which still combines specifically with the antigen. This treatment was, therefore, applied to the antisera against antifertilizin and the non-agglutinating antibodies thereby obtained were tested for possible action on the fertilizing power of the sperm. Using the sea-urchin *Lytechinus pictus* and the gephyrean worm *Urechis caupo*, it was found that such treatment resulted in considerable reduction of the fertilizing power of the sperm. In different tests the reduction ranged from 32-fold to greater than 128-fold on the basis of the minimum amounts of sperm required to effect fertilization after treatment with the homologous antiserum as compared with the amounts required after treatment with similarly photo-oxidized heterologous antisera or normal sera. The spermatozoa showed no visible effect of treatment with the antisera and they were also found to be quite as active as the controls.

Since antibodies prepared against a constituent of the sperm are effective in interfering with its fertilizing power it would appear that this constituent, namely antifertilizin, normally participates actively in the fertilization process. However, the results do not necessarily mean that those specific groups or structures of the antifertilizin molecule, by which it combines with fertilizin as an initial step in fertilization, are the same as those that

serve as the active antigenic determinants in producing antibodies in the rabbit. Conceivably the antibodies may be directed against other specific groups and their presence on the egg surface blocks, in steric manner, the action of those involved in the reaction with fertilizin. Information concerning this may be obtained from tests that are planned with cross-fertilizing species.

Electron microscope examination was made of the sperm treated with the "univalent" antibodies and no evident difference from control sperm was noted. Such examination was also made of sperm from which antifertilizin had been extracted by dilute acid sea water. The sperm extracted at pH 3.5 were found to be spherical and swollen in the region of the head between acrosome and midpiece. The swelling increased down to pH 2.8 but acrosome and midpiece were still unaffected. It appears then that antifertilizin is not derived from acrosome and midpiece but rather from the intervening part of the head.

For complete references to earlier work see: F. R. Lillie, "Problems of Fertilization", Univ. of Chicago Press (1919); F. R. Lillie and E. E. Just, *Fertilization*, Sect. 8 of "General Cytology" by E. V. Cowdry (1924); E. E. Just, *Protoplasma*, **10**, 300-342 (1930).

For some references to later work see: M. Hartman, O. Schartau and K. Wallenfels, *Biol. Zentralb.*, **60**, 398-423 (1940); J. Runnström, A. Tiselius and E. Vassaur, *Ark. f. Kemi*, **15A** No 16, 1-18 (1942); J. Runnström, A. Tiselius and S. Lindvall, *Ark. f. Zool.*, **36A** No 22, 1-25 (1945); A. Tyler, *West. Jour. Surg. Obst. and Gynec.*, **50**, 126-138 (1942); A. Tyler, *Proc. Nat. Acad. Sci.*, **28**, 391-395 (1942); A. Tyler *Proc. Soc. Exp. Biol. Med.* In press (1946).

## NOTES FROM THE INVERTEBRATE CLASS

Most of the would-be invertebrate zoologists had their first formal introduction to Woods Hole, Monday evening, July 22. Dr. Brown told us briefly about the Marine Biological Laboratory, and pointed out the "dangers" of Woods Hole. We were warned against poison ivy, sunburn, and amateur sailing. To help us in any attempted navigation we each were given a chart of the tides and several maps of the Woods Hole area. Dr. Redfield reinforced all the advice about local sailing with an interesting lecture about the oceans.

It seemed pretty early when we got up for our first day of waiting tables or eating at the Mess. After breakfast we started right in with a lecture on protozoa by Dr. Burbanck ("I am the last of a fine family and I'm very sensitive about that c!") The rest of the time we bravely hunted protozoa in samples of water from all the local ponds and in-

lets. The motile protozoa seemed to be especially annoying. You can never keep them in focus or still enough to draw and when you tried staining them you could never find them again. After battling with these microscopic organisms all morning, one of the more considerate tables had the bright idea of putting a "cuss-card" on the table. Now if any one is angry he can read it instead of bothering the people around him, or if he is especially peeved he can add his own favorite comment. It works marvelously.

We really got to know some of the professors on our first field trip. One of the graduate students misunderstood Dr. Lockhead's name and blithely introduced him to the rest of the team as Dr. Blockhead. It was a cloudy day, but Joe managed to develop an excellent, if rather temporary, sunburn. In spite of the rocks and barnacles we all enjoyed our excursion to Stoney Beach.

(Continued on Page 34)

## THE EFFECTS OF MUSTARD VESICANTS ON THE HEMOPOIETIC ORGANS<sup>1</sup>

DR. JAMES E. KINDRED

*Professor of Anatomy, Medical School, University of Virginia*

The objective of this investigation was to make a quantitative histologic assay of the changes which occur in the thymus, cervical lymph nodes, spleen and bone marrow of young adult albino rats intravenously injected with lethal doses of sulphur and nitrogen mustard vesicants. The control rats were injected with saline. All of the rats were starved, and killed at intervals of one day for a period of four days.

All rats injected with the agents showed significant lymphopenia which was correlated with destruction of lymphocytes, particularly of the medium-sized variety, in the cortex of the thymus, lymphoid nodules of the cervical lymph nodes and spleen. Mitosis in these cells was inhibited for two days. The injured cells were ingested and digested by macrophages of reticulum cell origin. In addition to loss of cells by action of the agents the lymphoid organs lost lymphocytes by migration. The latter activity is believed to be an attempt to maintain the lymphocyte content of the blood in the absence of normal production of lymphocytes in the injured organs.

Regeneration of the lymphoid organs began on the third day after injection and was characterized

by increase in the number of medium-sized lymphocytes and by increase in mitotic activity of these cells.

The neutrophils of the blood were significantly reduced in number only in rats injected with methyl bis (beta dichloroethyl) amine and with tris (beta dichloroethyl) amine. In all groups, however, there was significant hypoplasia and hyperemia of the bone marrow. This hypoplasia was characterized by initial decrease in the number of myelocytes, of myelocytes in mitosis, of erythroblasts and normoblasts and of mitotic activity in these cells.

Mature granulocytes decreased in number on the second day and were not replaced during the four day experimental period although the bone marrow during the third and fourth days of the period showed regeneration of myelocytes and restoration of mitotic activity to normal levels.

There appeared to be no consistent correlation between hypoplastic changes in the bone marrow and the number of circulating granulocytes, such as was observed between lymphopoietic centers and the lymphocytes of the blood.

## AN ANALYSIS OF THE INDUCTION OF THE EAR VESICLE IN THE SALAMANDER EMBRYO

DR. C. L. YNTEMA

*Assistant Professor of Anatomy, Cornell University Medical College*

The induction of the ear vesicle from foreign ectoderm was studied in the embryo of *Ambystoma punctatum*. In most of the experiments, gill ectoderm from a donor was placed in the ear region of a host in a dorsodorsal anteroposterior orientation.

The resulting labyrinths varied in normality. In certain combinations, perfectly normal labyrinths arose from the grafted ectoderm. In others, the vesicles were abnormal to varying extents; the smaller ones may have a sensory area and a cartilaginous capsule or these may be absent. In some instances, no vesicles formed.

A need for correlating conditions in a large number of experiments became apparent. The need was met by grading the labyrinths according to the presence of structures and their normality. A normal labyrinth is represented by 100%; the absence of a vesicle by 0%; intervening percentages indicate more or less abnormal labyrinths.

Combinations of donor and host at the same stage were used for one series of experiments. It was seen that prospective gill ectoderm of the late gastrula is able to form normal labyrinths. With advance in stage, the ability falls off to nearly 0% by Stage 28 of Harrison's normal series.

The question as to what part is played by the

donor and what by the host in these inductions goes unanswered by such a series of experiments in which both hosts and donors are at the same stages of development. This was realized some years ago and a study of inductions was undertaken in which the hosts and donors were not necessarily at the same stage at the time of operation.

The youngest donors were middle gastrulae (Stage 10), the youngest hosts late gastrulae (Stage 12). The oldest donors were in an early tail bud stage (Stage 28), the oldest hosts in a freely swimming stage (Stage 35). Approximately, 1,000 experiments belonging to 100 classes of stage combinations were studied.

In summary, the following implications were drawn from the results. The induction of the ear goes through two periods of maximal activity. They occur near the beginning and near the end of *neurulation*. The first period is considered to be associated with mesodermal induction; the second with neural induction. An activation and a response characterize each period of induction. Mesodermal activation appears to be greatest at Stage 14, neural activation at Stage 20. The two periods of maximal response, Stages 13 and 18

<sup>1</sup>This work was done under contract with the Medical Division of the Chemical Warfare Service.

respectively, occur shortly before their respective periods of maximal activations. There is evidence that the inductions are qualitatively different both as to activation and response. Mesodermal activation is transitory, but neural activation lasts at a low intensity at least through Stage 35. Ability on the part of the gill ectoderm to respond to both activations persists through Stage 28. The gill

ectoderm develops competence to respond to neural activation during Stages 16 and 17.

Implications of the results can be illustrated by a three dimensional graph in which stages of hosts and donors determine the two axes in the horizontal plane and normality of responses the vertical coordinates.

## OFFICIAL NOTICES CONCERNING ELECTION OF TRUSTEES

The following notices were posted on the official Bulletin board of the Marine Biological Laboratory on the dates indicated.

At the annual meeting of the Corporation; to be held on Tuesday, August 13, eight Trustees of the class of 1950 are to be elected; and one Trustee in place of W. C. Curtis, who retires.

Of the outgoing class of 1946, six Trustees only are eligible for re-election, namely; D. E. S. Brown, E. R. Clark, M. H. Jacobs, A. K. Parpart, Franz Schrader, B. H. Willier.

The remaining members of this class, O. C. Glaser and E. N. Harvey, being Trustees ex-officio, are not eligible for re-election as regular Trustees.

*For Treasurer, D. M. Brodie; For Clerk, O. C. Glaser. Eight Trustees of the Class of 1950s D. E. S. Brown, F. A. Brown, C. L. Claff, E. R. Clark, Hope Hibbard, M. H. Jacobs, A. K. Parpart, B. H. Willier. One Trustee to replace W. C. Curtis, retired: D. A. Marsland.*

Your attention is called to the fact that the by-laws of the Corporation state that the Vice-President and Clerk of the Corporation among others shall be trustees ex-officio. Therefore, on instructions from the executive committee, E. N. Harvey and O. C. Glaser have not been considered as candidates for re-election to trusteeship in the class of 1950. Since this ruling was not made known to members of the Corporation at the time suggestions for candidates were called for, and also because the committee wishes to break with the tradition of a fixed slate, it feels that additional nominations are in order. On the basis of suggestions made by members of the Corporation we also nominate the following individuals as candidates for any of the nine vacancies to be filled: Ethel B. Harvey, B. Lucke, F. Schrader, H. B. Steinbach.

*Nominating Committee: W. R. AMBERSON,  
E. G. BALL, K. S. COLE, C. C. SPEIDEL,  
D. R. STEWART.*

## THE M.B.L. SQUARE DANCES

The square dances, held on Thursday nights in the M.B.L. club house, have been attended by large crowds of energetic and happy-faced people. Everybody has performed beautifully in schottisches, polkas, squares, waltzes and Virginia reels. People who say they had never square-danced before now "allemand left" with a distinctly professional look. In order to accommodate all enthusiasts, it has been necessary to have some dancing out on the lawn. The "management" wishes to thank the Thursday evening participants for the enthusiasm and support which has made the square dances so much fun for all of us and which has reduced the work of organization considerably.

## TENNIS CLUB NOTES

The Tournament Committee, Dr. S. P. Hayes and Mrs. W. D. Burbanck, have announced the opening of the women's singles and doubles, the mixed doubles and the men's singles and doubles. The first round is to be played off by August 9th. Those interested should sign up immediately on the sheets provided for the purpose at the Mess and Beach courts.

Mrs. Eric G. Ball and Dr. P. B. Armstrong have been named as the Nominating Committee for the officers of the club for next year.

The second Beach court has just been opened. This makes 3 good courts now available for play.

The annual meeting of the club will be held in the Committee Room, August 7th at 7:30 P.M.

## NOTICE TO LOCAL PHOTOGRAPHERS

The M.B.L. is interested in obtaining various photographs of M.B.L. buildings, both from within and without; M.B.L. personnel comprising the staff, investigators, supply department, students, visitors, etc.; all activities—investigational, social, athletic and miscellaneous; M.L.B. equipment of all kinds; various views of Woods Hole; Woods Hole points of interest and the Woods Holeians at work and at play.

All pictures accepted, whether in color or black and white, will be bought by the Laboratory and, in addition, a copy of the original print or transparency will be furnished the photographer. For further details and information, consult Dr. Zinn in 122B.



## The Collecting Net

A fortnightly publication devoted to the scientific work at marine biological laboratories

Edited by Ware Cattell with the assistance of Ruth Scott and Jane Carruthers.

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### Introducing

Dr. Tage U. H. Ellinger, Sc. D., M.A., Head of the Department of Zoology at Howard University in Washington, D. C.

While his father, a physicist, at eighty-nine remains active at the University of Copenhagen, Dr. Ellinger carries on the family tradition for energy by working on three projects here at Woods Hole. He is making a complete museum collection of the local fauna, setting up genetics experiments on the hymenopterous egg parasite, *Trichogamma*, and is also finishing a book on the earliest known textbook on embryology written by an unknown Greek at the time of Socrates.

With a war record that many a younger man could envy, Dr. Ellinger served as head of a French field hospital in Finland during the Russo-Finnish war, in Norway as commanding officer of a heavy machine gun unit, and in England as an officer with the Scots Guard. Dr. Ellinger and three of his lieutenants were the only ones of a force of eight hundred to escape at the evacuation of Andersness.

When the danger was over in England, he returned to this country to work in Henry Wallace's Board of Economic Warfare and taught genetics at the Department of Agriculture Graduate School. Stimulated by his war experiences, he ventured a year ago to take a master's degree in international law and international relations.

Last September, he was appointed head of the department of zoology at Howard University, succeeding Dr. Just. Dr. Ellinger brings two of his Negro students with him this Summer and is making his collection of marine animals to acquaint the student in zoology at Howard with marine biology before they come to Woods Hole.

At the University of Copenhagen under Boas, he majored in zoology specializing in protozoology. Later work with Nilsson-Ehle and Johansen aroused his interest in genetics. However, he wrote his first paper on the influence of tempera-

ture on the metabolism of insects while working with the Nobel-prize winner, August Krogh. A fellowship in the American Scandinavian Foundation brought him to this country for the first time in 1920 (he has been an American citizen since 1926) to study with Pearl and Jennings at Johns Hopkins and with Castle, East and Wheeler at Harvard University where he received his Sc. D.

Dr. Ellinger considers his most distinguished contribution to science his six years' work as director of research with the International Corn Borer Investigations. Financed by private industrial concerns in Chicago, the investigations had headquarters in the Pasteur Institute in Paris with branch laboratories in ten European countries as far east as the Caspian Sea; including France, Germany, Denmark, Sweden, Poland, Hungary, Yugoslavia, Roumania, Soviet Union and Italy. The results of this work fill four volumes of scientific reports.

Being a Scandinavian, Dr. Ellinger loves to ski and claims that he is an excellent swimmer. Unrelated to his interest in athletics, is his great love and admiration for the ancient Greeks. Although admitting it to be a slight exaggeration, he states that "a modern text-book in zoology could be written as foot-notes to Aristotle."

### NOMINATIONS FOR TRUSTEES

The Nominating Committee of the Corporation of the Marine Biological Laboratory is to be congratulated for the number and quality of the candidates it has presented for trusteeship. It has broken with precedent, proposing four more members than are needed to fill the vacancies. So far as we are aware, it is the first time in the history of the Laboratory that Corporation members have been allowed a selection.

There had been mounting indignation on the part of many corporation members because, to all practical purposes, members were appointed rather than elected to trusteeship. During the past week a group of Corporation members had selected three persons whom they had planned to nominate from the floor on August 13. It is interesting to note that two out of the three they chose appear on the nominating committee list. The members of the self-appointed "floor" nominating committee are so well pleased with the report of the official nominators that they will present no names for consideration. All groups are well satisfied.

## ITEMS OF INTEREST

## SPECIAL LECTURES IN OCEANOGRAPHY

These lectures were sponsored by the Invertebrate Course in Zoology: "The Sea as an Environment", Dr. A. C. Redfield; "Ocean Currents", C. O'D. Iselin; "The Tide", Dr. A. C. Redfield; "Geographical Distribution of Marine Animals", Dr. L. Hutchins; "Nutrition in the Sea", Dr. B. H. Ketcham and "Food Resources of the Sea", Dr. G. L. Clarke. The last of these will be presented on August 8.

The annual meeting of the corporation of the Marine Biological Laboratory will be held on August 13, at 11:30 A.M. The annual meeting of the trustees will be held on the same day in the morning and the afternoon.

DR. FRANK R. KILLE, professor of zoology at Carleton College, has been appointed Dean of the institution for 1947. Dr. Kille was a recipient of one of *The Collecting Net* Scholarships as a result of his outstanding work in the invertebrate course at the M. B. L. in 1931.

DR. ROBERT BOGGS, assistant professor of anatomy at the New York College of Medicine, has been appointed an assistant dean of the Medical College.

DR. BOSHI SEN, director of the Vivekananda Laboratory at Almora, U. P. India, will sail from Bombay for San Francisco, August 12, on the General Gordon. Their reservations on an earlier boat cancelled by the U.S. Government, Dr. and Mrs. Sen will arrive in this country too late to come to Woods Hole this summer. Dr. Sen is travelling on a fellowship from the Watumull Foundation.

## LETTER FROM DR. MEYERHOFF

A letter dated July 29 arrived from Dr. Meyerhoff of AAAS expressing appreciation of his visit to the MBL last week. Regarding the National Science Foundation legislation, he says:

"Thus far I have heard nothing further regarding science legislation, but I seriously doubt that there shall be any developments to report. Congress expects to adjourn this week, and about the only thing on Congressional minds is to get the business over and to get away. Thereafter I hope we shall have some uninterrupted time to lay the foundation for the passage of National Science Foundation legislation either late in the fall or early next year. Meanwhile, we must all keep working on the scientists, as well as upon congressmen who are reasonably sure to return. Both groups are equally important, as I hope I convinced my listeners last Thursday evening."

## WHAT BIOLOGISTS HERE TALK ABOUT

The rivalry between MBL and WHOI . . . the approaching MBL Corporation meeting . . . the depleted Executive Committee (only one Trustee who is not *ex-officio* attending this summer's meetings . . . the amusing situation that has permitted two *ex-officio* trustees of the class of 1946 to serve on the Board for two years . . . the fact that members of the corporation were not told they were ineligible to serve when the nomination blanks were sent out in July . . . the fact that notice of this "discovery" was not bulletined until the day after members were required to submit their suggestions . . . the fact that, although elected for a four-year term, a member once a trustee, has always been a voting trustee for life, or until seventy.

The increasing number of visiting foreign biologists . . . the need for funds . . . the good but meager fare at the Mess . . . the time it takes to get it . . . the shortage of living quarters . . . the new white picket fence enclosing the grassy plot between the dormitory and the Kahler House.

The reception, hostessed by Mrs. Ball, for the MBL Associates and Trustees after Dr. Cole's lecture . . . the forthcoming mixers for students . . . the Sunday evening musicales at the Club . . . the increasing number who attend the square dances sponsored by the MBL and WHOI.

The large boulders brought to the Bay Shore Bathing Beach last Saturday by one of the Trustees . . . the wall, extending too far into the water, along the edge of the M.B.L. beach lot—it aggravates adults, it delights small children who are tempted to the "private" side: the wall serves as a diving board, as a fort, as hiding quarters.

The proposed Institute of Biology . . . Heilbrunn's criticism of the past chairman of the division heads of the National Research Council . . . Science legislation — activated by Chambers, Grundfest, and Willard . . . the barring of members' sons and daughters under 18 years of age from the M.B.L. Club after 7:00 p.m. (why not make it under 16?)

The new coat of paint on Community Hall, the teen age's club in its basement and the campaign for funds spearheaded by Mrs. Alfred C. Redfield . . . The "atomic" bomb explosions off Nonesmasset . . . The congested condition of Main Street now that cars can park on both sides of the street . . . The dozen yellow summons cards for too-extensive parking stuck on as many cars parked by the Brick Building one morning last week . . . the one-way street around the block containing the Post Office . . . the 15¢ ice cream cones . . . the high cost of living . . . the weather.

—Catalyst

## NOTES FROM THE INVERTEBRATE COURSE

(Continued from Page 29)

The second field trip was even more fun. By then we recognized at least a few of the most common forms and we were used to carrying buckets, shovel and Arks every place. No one had to chase any float-away buckets this time.

Before Saturday we had covered two of the three sub-kingdoms. No wonder we were lamenting the shortness of our eighteen-hour working day.

And then there was the mixer. In between big biologists we ate. We saw the author of our textbook and ate a cheese sandwich, found out who the guy was who had the wonderful *Vorticella*, grabbed a piece of cake and navigated towards the

punch bowl, just in time to have Dr. Somebody pointed out. Everyone looked peculiar with ties and coats, or skirts as the case may be. The "grown-ups" went home to make room for dancing. Protozoas faded into the dim dark corners of our minds and we relaxed. Twelve p. m. found some of us hearing the Cap'n Kidd's final bell, while others threw their paper cups out of the Club House bay windows, and so to bed—pleasantly full (with due apologies to the Mess), beginning to feel more a part of the M.B.L.

Although we've only been here a week we already love Woods Hole and most of us hope to spend many more Summers here. —*The Inverts*

## BOTANY CLASS ACTIVITIES

July 16—Our initiation to the *Nereis* . . . all hands on deck including Mrs. Taylor and Jimmy at 9:00 a. m. . . an all day trip to the island ponds . . . first stop at Pasque with a ten foot jump . . . but with "If the older ones do not wish to jump, come back" a mad scramble to hop down! Then into the rowboat over the channel to a bed of Charis . . . more luck . . . back to the *Nereis* for lunch . . . on to Tarpaulin Cove . . . up and down hills . . . in and out of ponds all rich with spoils . . . a glimpse of sheep shearing . . . home.

July 20—We start the Browns with Dr. Doty setting a new pace! At 2 o'clock we are all crowded again in the good old M. B. L. truck to Nobska . . . our first search for marines! And greens don't count! New troubles . . . sand, rocks and waves . . . and mounting far into the night but refreshing tea and crackers as always.

July 24—Waves of yesterday under control again . . . our rowboat trip is on . . . greens count now . . . collecting is fun . . . one false step . . . down 12 feet . . . the Spindle and U. S. Fish Commission Pier teach us that pastures are green at home with Ulva, Enteromorpha and Cladophora! Let's not forget Bangia! . . . more mounting but a real treat in the evening . . . Ed Moul gave a vivid description of the marine flora and those of the salt marshes of the Cape with reasons . . .

now we know what goes into the vasculum! The tea following was super with all our Botany friends with us . . .

July 26—A Northeaster . . . trip postponed.

July 27—Sunny and calm . . . and off to Penikese . . . full of interest . . . hundreds of birds greet us. Ed introduces us to the island . . . a climb to the monument . . . rescue of the gulls and the tern . . . and the three men! . . . the birds have reclaimed this place . . . eggs everywhere . . . and oh, that water! Slippery rocks . . . but Corallina lends a footing . . . more specimens . . . back to lunch on the beach . . . more searching . . . a split into teams . . . ours for the *Mytilus* gathering . . . with great anticipation of the evening ahead . . . another party . . . mounting again . . . then our friends back again for the feast!

July 29—Still on the Browns . . . with cross sections 10 microns thick???

July 30—Again the *Nereis* carries us off to dredging and Gayhead . . . The waves toss us about . . . yes, the water tastes briny . . . but we have fun 'til dredging . . . but Alma, here comes land . . . lunch on the beach and off again to fight the sand and waves . . . What! No *L. digitata*?? But other treasures carefully guarded and goose neck mussels . . . a short mounting session . . . and now for a good night's sleep! —*M.K.*

## PHYSIOLOGY CLASS NEWS

The physiology course is over, and we students reluctantly pull our fingers out of the pie of measurable truth, or from the cookery classes on how to make truth measurable. Some leave Woods Hole, some stay, to work on their own. All carry the knowledge that Woods Hole is the happy hunting ground for biologists, and shall try to return.

The last two weeks of the course have been saved enjoying demi-tasse sips of the science of crystallography, under Dorothy Wrinch, or of microtechnique, particularly cartesian diver respirometry, under Claff and Anfinsen, or doing problems under members of the staff, each of whom guided a few of us. My own rare pleasure was

to study crystals under Dr. Wrinch, to pile tapioca spheres the closest, to handle diamond molecules, and others, bodily brought out of their Angstrom world into my own crass units of toe to heel, and to glimmer how Angstrom regularities can produce regularities in muscle, tissue. . . .

The class picnic came off the other day, to Washburn Island: Dave Jofes, chairman and beer taster, Dr. Abajian, cook. Grand time, grand feed—steak on an open fire. . . .

As students we thank the staff and other lecturers for this hand along. We've had a \*\*\*\* good time. As investigators we shall see that truth goes marching on. —*C.C.*



## THE BERMUDA BIOLOGICAL STATION FOR RESEARCH

(Continued from Page 1)

rise so steeply from the sea floor that depths greater than 2,000 fathoms are reached within a few miles of sheltered waters. This would make it possible to carry on serious investigations at great depths with small and inexpensive vessels, and the fact that such work could be done in one-day trips would allow an advantageous unity between field and laboratory work.

"(2) The Bermuda cone occupies so small an area that the fundamentally oceanic character of the neighboring waters is not disturbed thereby.

"(3) There are two entirely submerged cones close to Bermuda, the 'Argus' and 'Challenger' banks.

"(4) In spite of the precipitous nature of their slopes, the Bermuda reefs enclose a considerable and entirely protected area of shoal water, supporting a rich and varied fauna, and illustrating many phenomena of lime deposition, erosion, etc.

"(5) The climate is mild, with no extremes, favoring work the year around, while living conditions are excellent with all the amenities of modern civilization."

The present main building of the Bermuda Station, a spacious lime-stone structure, was built originally as a sanitarium-hotel. It faces out across Ferry Reach and the new American Air Field toward the unbelievably blue waters of Castle Harbor. The laboratory rooms and living quarters can accommodate about 35 workers and their families while the grounds (14 acres) provide a lovely setting for the buildings. In addition to the laboratory, the buildings include a library and shop, a pump house, the coach-house (which is being converted into a dining hall and small apartments), a combination bath-house and recreation center and five cottages.

The original Bermuda Biological Station was started in 1903 under the joint auspices of Harvard and New York Universities with Drs. E. D. Mark and C. L. Bristol serving, respectively, as director and associate director. The present organization, however, was conceived in 1925, at a meeting held here at Woods Hole under the leadership of Dr. E. G. Conklin. In fact, as to constitution and general organization, the Bermuda Station follows the pattern of the Marine Biological Laboratory; the staff of the M. B. L. gave considerable help in planning the facilities and making equipment when the present building and grounds were acquired in 1931.

International cooperation always has been a keynote in the development of the Bermuda Station. The Bermuda Government has aided generously with an annual grant of 200 pounds. An initial gift of \$243,265 from the Rockefeller Foundation made it possible to acquire the buildings and grounds and to equip them as a research center. The Woods Hole Oceanographic Institution

has helped consistently by sending many workers to the laboratory. One of its contributions is that of the services of Norman T. Allen who serves in the capacity of business manager for the Bermuda Station. Before the war, the Royal Society gave the services of a 40-foot oceanographic vessel the *Culver* and contributed more than \$10,000 to support its work; during the war, the U. S. army paid a considerable sum for the use of the property. Moreover, quite a number of universities in England, Canada and the United States have consistently supported the program of the Bermuda Biological Station through the annual rental of research rooms.

The Bermuda Station is now preparing for a new and extensive program of physiological, ecological and oceanographic research. During the war, while the plant was used as a hospital, most of the furniture and some of the scientific equipment had to be disposed of, but in recent months Dr. Hillary B. Moore, the ad interim director of the station, has done much toward restoring the facilities. In fact Dr. Moore, in resuming his duties as the resident naturalist and in taking up his ecological and physiological researches, can be proud of the fact that the new director will find the station so well prepared for the post-war program.

It seems inevitable that the central theme of the new program will involve an intensive study of the deep-sea environment, with special emphasis on the pressure and temperature factors in relation to the physiology, embryology and ecology of deep-sea and surface-dwelling forms. Dr. Brown's well-known work on the physiology of high pressure provides an excellent foundation for such a program; the Bermuda location will give it an almost unlimited scope. Moreover, the continued cooperation of the Woods Hole Oceanographic Institution, which soon will send the *Atlantis* to Bermuda to establish a "Wave Station", assures the solution of many difficult problems which are bound to beset any investigation of the deep-sea environment.

Although high pressure studies are likely to become the specialty of the station, the abundance of life in the Bermuda waters will provide favorable material for many other lines of work. The coral reefs are larded with Coelenterates, Echinoderms, Ascidians, Algae, etc. If one puts on a diving helmet and walks along the sandy bottom toward the sides of a reef the perfect clearness of the water reveals a beautiful array of form and color. In addition, there are many shallow bays and inlets near the laboratory where tidal organisms may be collected in abundance. And finally the Bermuda islands are a quaint and different land of friendly people; one returns from Bermuda refreshed with the sense of coming back from a beautiful and distant place.

## Supplementary M. B. L. Directory

### ADDITIONAL INVESTIGATORS

- Bartlett, J. H. prof. theoretical physics. Illinois. Br 228.  
 Blumenthal, Gertrude. Pennsylvania. Br 219.  
 Bocher, Carol A. res. asst. Johns Hopkins. Lib.  
 Burt, Agnes S. res. asst. Chicago. Br 304.  
 Clowes, G. H. A. res. dir. emerit. Lilly Research Lab.  
 Cooper, K. W. assoc. prof. biol. Princeton. Br 127.  
 Curtis, W. C. prof. zool. Missouri. Br 213 D212.  
 Dey, T. E. res. asst. biol. Princeton. OM 2.  
 Frost, Jane C. visit. lec. zool. Oberlin. Br 218.  
 Gates, R. R. prof. emerit. bot. London. Br 210.  
 Gonzalez, J. asst. prof. phys. Natl. Polytech. Inst. (Mexico City). Br 111.  
 Greenberg, R. grad. phys. Ohio Med. Br 111.  
 Grossman, Celia. res. asst. neur. Columbia. Br 336.  
 Krah, M. E. asst. prof. pharm. Washington (St. Louis).  
 Lower, G. G. teach. biol. Upper Darby Sr. High. Br 206.  
 Mathews, A. P. prof. emerit. biochem. Cincinnati.  
 Mayor, J. W. res. prof. Union (Schenectady). Lib. F.  
 Meyerhof, O. res. prof. biochem. Pennsylvania. Lib. A.  
 Plough, H. H. prof. biol. Amherst. Om 22.  
 Ricknagel, R. O. grad. zool. Pennsylvania. Br 219.  
 Shanhey, Sister Francis Jerome. instr. biol. St. Mary of the Springs (Ohio). Br 111.  
 Sheng, T. C. grad. zool. Columbia. Br 314.  
 Stunkard, H. W. prof. biol. New York. Br 332.  
 Sturtevant, A. H. prof. genetics. Cal. Inst. Tech. Br 334.  
 Weber, N. A. assoc. prof. anat. North Dakota. Rock 7.

### STUDENTS IN INVERTEBRATE ZOOLOGY

- Ambersson, Margaret M. Oberlin zool.  
 Banner, A. H. asst. prof. zool. Hawaii zool. F 5b.  
 Bergquist, Jeanne B. Barnard zool. K 3.  
 Bernsau, Margaret I. Wilson College zool. H 7.  
 Bingham, Barbara A. Michigan zool. W e.  
 Candelas, G. A. asst. inst. zool. (Puerto Rico) zool. F 49.  
 Cattell, Elly. Cornell zool.  
 Chadwick, J. B. Grad. zool. Swarthmore zool. F 47.  
 Chiveas, Mirian E. Howard zool. graduate D 10.  
 Crocker, D. W. grad. asst. zool. Cornell zool.  
 Edwards, J. P. Drury (Mo.) zool.  
 Ehrentheil, Susann J. Radcliffe zool. W c.  
 Emerson, Julia R. Wellesley zool. K 1.  
 Enders, Abbie G. Swarthmore zool. W e.  
 Feld, Emily A. North Carolina zool. H 1.  
 Ferguson, E. L. Wesleyan zool. K 6.  
 Foley, J. B. Lab. asst. zool. Yale zool. F 45.  
 Foreman, Darhl L. George Washington zool. W d.  
 Fullerton, Ann E. Western Maryland zool. H 4.  
 Gehr, Agnes R. Western Reserve zool. H 6.  
 Gese, E. C. Grad. asst. zool. New York zool. D 107.  
 Gese, Phyllis K. grad. New York zool. D 107.  
 Hackett, T. P. Cincinnati zool.  
 Hand, C. H. asst. zool. Connecticut zool.  
 Hopkins, A. L. Jr. Harvard zool. K 7.  
 Hopp, W. B. grad. asst. biol. Purdue zool. K 6.  
 Humphrey, Judith M. Connecticut zool. K 1.  
 Jakowska, Sophie, grad biol. Fordham zool. K 10.  
 Kenyon, V. Patricia. grad. biol. Brown zool. W f.  
 Kramer, D. grad. Clark zool. F 55.

- Liberti, A. V. grad. biol. Fordham zool. Da 11.  
 Liu, Chien-Kang. grad. zool. McGill zool. F 44.  
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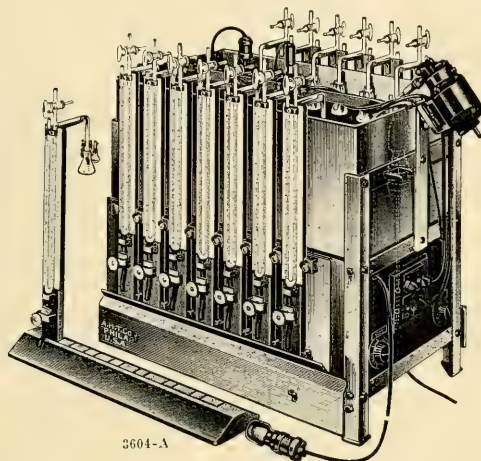
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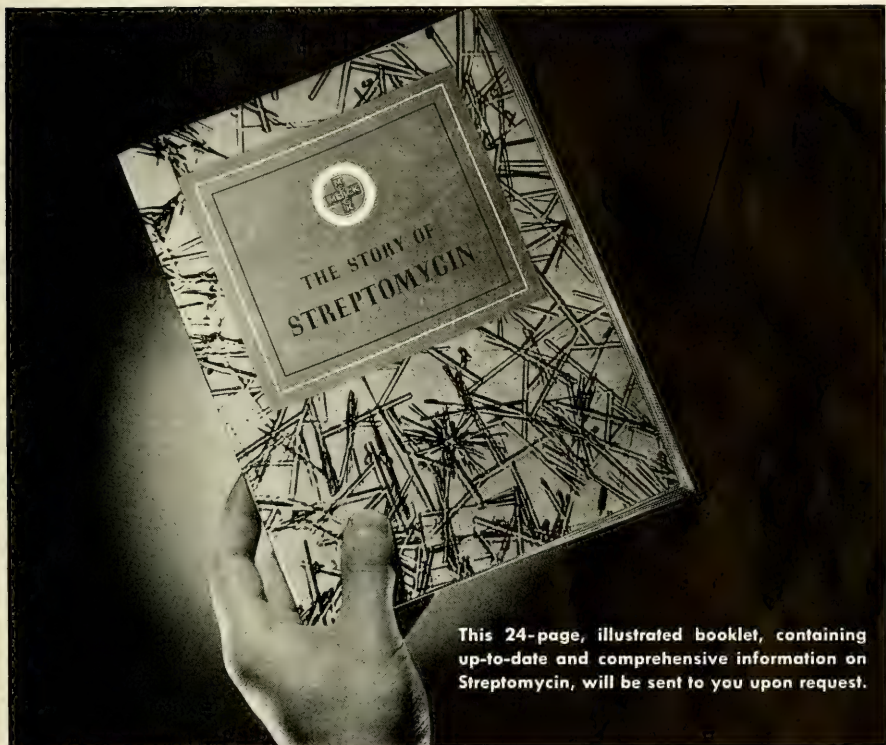
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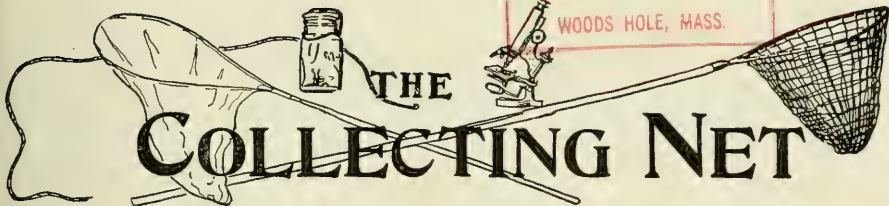
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## SOME INTERMEDIATE STEPS IN THE VISUAL CYCLE

DR. A. F. BLISS  
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Nevertheless, the bleaching of vertebrate visual pigments is an interesting and complex process whose steps have not hitherto been fitted together. The first known product of bleaching (*Page 55*)

## OFFICIAL MEETINGS OF THE MARINE BIOLOGICAL LABORATORY

DR. CHARLES PACKARD  
*Director, Marine Biological Laboratory*

The Annual Meeting of the Corporation of the Marine Biological Laboratory was marked by an innovation; on the Nominating Committee's list of nominees for Trustees there were more names than places to be filled. To this list were added several names proposed from the floor. The result of the balloting was as follows:

*Treasurer*—D. M. Brodie (re-elected), *Clerk*—O. C. Glaser (re-elected), *Trustees, Class of 1950*—D. E. S. Brown (re-elected), D. P. Costello, M. H. Jacobs (re-elected), D. A. Marsland, A. K. Parpart (re-elected), Franz Schrader (re-elected), H. B. Steinbach, B. H. Willier (re-elected), *Class of 1949*—F. A. Brown, *Trustee Emeritus*—W. C. Curtis.

The remainder of the session was given over to reports. The Director spoke of the excellent work of Mr. C. L. Claff as Chairman of the Special Repairs Committee. The most urgent repairs mentioned in the report of this Committee have

## Announcement

*The Collecting Net*, using Woods Hole as its proving ground, long ago demonstrated the value of an informal, frequently-published news magazine for biologists. THE SCIENCE PRESS takes pride in announcing its year-round publication under the more appropriate title, *The Biological Scientist*. The foundation number will be published in November.

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#### STAFF AND STUDENTS OF THE INVERTEBRATE ZOOLOGY CLASS

Back Row: D. Morris, E. Robinson, G. Candelas, A. Bannier, H. Saslow, E. Williams, A. Hopkins, Mary Wartens, W. Hopp, A. Liberti, E. Gese, M. Meinkeoth, W. Peters, J. Edwards, D. Crocker.  
 4th Row: Margaret Sanderson, Mary Rice, Drusilla Van Hoesen, Kathleen Warner, Margaret Bernsau, Suzanne Ehrentheil, Trudy Enders, C. Hand, Phyllis Gese, M. Mendes, Janet Vivian.  
 3rd Row: Dr. Madelene E. Pierce, Antoinette Baca, Dr. W. D. Burbank, Dr. Mary D. Rogick, Dr. J. H. Lochhead, Dr. F. A. Brown, Jr., Dr. W. M. Reid, Dr. T. H. Bullock, Dr. C. G. Goodchild, Mary Thompson.  
 2nd Row: Agnes Gehr, Katherine Wetmore, C. Liu, Margaret Amberson, Jeanne Bergquist, E. Ferguson, J. Foley, N. Pollens, D. Kramer, J. Moulton, Julia Emerson, D. Foreman, Emily Feld, Barbara Bingham, J. Chadwick, Miriam Chivers.  
 Front Row: T. Sullivan, P. Seiner, Ann Swanson, S. Jakowska, Ann Fullerton, Betty Miller, Judith Humphrey, Patricia Kenyon, T. Smith, Eleth Cattell.



## OFFICIAL MEETINGS OF THE MARINE BIOLOGICAL LABORATORY

(Continued from Page 45)

been made. The Mess and Botany Building are now in excellent shape; the walls of the Crane building and a part of the Brick Building have been water-proofed; a new boat shed provides shelter for the two smaller boats; repairs have also been made on the Rockefeller Building and in the Supply Department. Still more have been authorized, and will be made as soon as labor and materials are available.

The need for better research facilities grows more and more pressing. We need a faster and larger collecting boat, and better means for storing live material; we should improve and increase our stock of apparatus, glassware, and chemicals. The Optical Laboratory, now being developed by Dr. Lavin, the Microtechnique Laboratory in charge of Mr. Claff and the Radiation Laboratory under the direction of Dr. Failla, should be expanded. In addition, cold rooms, de-humidified rooms, and other special services should be made available.

The Librarian, Mrs. Montgomery, spoke of the reprint collection, and urged all members to send copies of their current reprints, and to suggest the names of biologists whose reprints should be in our files.

The Treasurer, Mr. Brodie, commented briefly on the present financial condition of the Laboratory, calling attention to the fact that the Reserve Fund and most of the Current Cash had been allocated to pay for repairs. Not all of the money thus earmarked had been spent.

The Clerk, Dr. Glaser, reported that with the new members, the total membership of the Corporation is now 419.

Dr. Little, Manager of the Apparatus and Chemical Departments, spoke of the greatly increased use of apparatus and chemical supplies. As evidence, he cited, among other items, that 10 tons of distilled water have been furnished to investigators this summer.

Dr. Conklin read a memorial for Dr. T. H. Morgan, and Dr. F. R. Lillie, a memorial for Dr. C. E. McClung. At the conclusion of the reading, the Corporation stood as a token of respect to these men who contributed so largely to the material and scientific activities of the Laboratory.

## MEETING OF TRUSTEES

The Trustees of the Laboratory held two sessions, one before the Corporation meeting and one in the afternoon. The following new members were elected to the Corporation: Dr. Gerrit Bevelander, Dr. E. J. Boell, Dr. Katherine Brownell,

Dr. D. W. Bronk, Dr. Paul R. Burkholder, Dr. Herbert S. Gasser, Dr. Harry Grundfest, Dr. H. L. Hamilton, Dr. Helen W. Kaan, Dr. Arnold Lazarow, Dr. L. J. Milne, Dr. R. H. Oster, Dr. F. J. Ryan, Dr. G. T. Scott, Dr. C. A. Villee, Dr. Anna R. Whiting.

Reports of Committees occupied most of the time of both sessions. Dr. Redfield, Chairman of the Library Committee, mentioned the increase in the contribution made by the Oceanographic Institution for the support of the Library. This was used to raise the salaries of some of the Library staff. Dr. Brooks, representing the Committee on Instruction, stated that the courses, with the exception of Botany, have their maximum number of students. The Embryology course, with 30, had 42 applicants; Physiology had 59 applicants, of whom only 26 could be admitted; 106 applied for Zoology, and 55 were admitted. Dr. Brooks remarked that more and more students are starting research problems in connection with their regular work. The Chairman of the Buildings and Grounds Committee, Dr. Ball, spoke of the repairs and improvements already completed, and of those which remain to be made. The playground for children at the Dormitory has proved most valuable. Dr. Armstrong mentioned the improvements made in the Supply Department. A new boat shed has been built, and new motors placed in the *Nereis* and *Sagitta*. The latter boat is now old and must soon be replaced. An elevator in the Stone Building is greatly needed. This would allow the capacious top floor of the building to be used for storage, thus freeing the boat shop for other purposes. The business of the Supply Department continues to increase under the able direction of Mr. McInnis.

After the report of the Special Repairs Committee, the Trustees unanimously adopted a resolution expressing the great appreciation of the Laboratory to Mr. Claff for his invaluable work as Chairman of the Committee.

Among other actions taken by the Trustees may be mentioned the following; the new members of the Executive Committee are M. H. Jacobs and A. K. Parpart. From now on, each member will serve 3 years instead of 2. There will therefore be a total of 6 elected members instead of 4 as at present.

The roads to be laid out in the Devil's Lane Tract will be named for F. R. Lillie, E. B. Wilson, T. H. Morgan, E. G. Conklin and Jacques Loeb.

## OXIDATION-REDUCTION STUDIES AS AN INTERPRETATION OF THE MECHANISM OF FERTILIZATION OF MARINE EGGS

DR. MATILDA MOLDENHAUER BROOKS

*Research Associate in Biology, University of California*

These experiments are an attempt to show that the mechanism of fertilization of marine eggs is related to the difference in potential between the egg and the sperm.

Concentrated suspensions of centrifuged eggs or "dry" sperm were measured for  $E_h$  and  $pH$  (referred to below as eggs and sperm). These terms were combined as  $r_{II}$  according to Clark's formula. *Arbacia punctulata* (1), *Asterias forbesii* (2) and *Chaetopterus pergamentacea* (3) were used. Correlations between the rate of  $O_2$  consumption of unfertilized and fertilized eggs and the redox potential were made (see previous report, Brooks, 1943).

The redox potential of sperm was found to be more positive than that of unfertilized eggs in the case of (1), not very different in the case of (2) and more negative in the case of (3). These values are in agreement with the change in rate of  $O_2$  consumption upon the fertilization of the eggs of these three animals.

Sea water has a higher redox potential than sperm. It appears to be lightly poised by the presence of sufficient concentrations of metabolites of animals, bacteria and plants. It also contains many elements such as iodine, iron, copper, arsenic and manganese, etc., either free or in combination and capable of appearing in redox systems (see Harvey, 1945). When sea water is diluted by hypertonic salt or sucrose solutions in proportions used as artificial parthenogenetic agents, the redox potential is lowered. The hypothesis suggested is that the redox potential of the sea water is too positive in most cases to produce parthenogenesis. When eggs are allowed to remain in sea water, they give off "egg water" which has a lower redox potential than sea water in the case of *Arbacia*.

*The fertilization membrane.*—Since the fertilization membrane can be produced in the presence of KCN or in the absence of  $O_2$ , it is concluded that its formation is not associated with aerobic oxidations. It can be considered in the light of a by-product. Since eggs can cleave without a fertilization membrane, this corroborates this conclusion. The membrane can be thought of as arising due to a result of a change in the physical state of the proteins. As the redox potential is changing on fertilization, an alteration in the surface layer or of the precursor of the membrane occurs, whether by denaturation or by a change in the aggregation of the protein molecules in solution. A

change in the redox potential could account for the formation of such a membrane by creating or destroying valencies. Such a process has been studied by Rapkine (1930) in the case of *Paracentrotus* eggs. He found changes in the concentration of the  $-SH$  radical thirty minutes after fertilization. Similarly, establishment of new bonding between protein molecules may be responsible for Heilbrunn's (1915) observation that the whole egg shows an increase in viscosity after fertilization. Denaturation offers the most logical allocation of these processes at present.

Some time after fertilization, there is a drop in the redox potential. The increase in concentration of the  $-SH$  radical at the beginning of the first cleavage (Rapkine, *loc. cit.*) agrees with this observation. As the larva develops there is a gradual rise in the redox potential to the pluteus stage.

The hypothesis underlying these experiments is based upon the assumption that the rate of  $O_2$  consumption of an egg depends upon the ratio of oxidants to reductants of the oxidation enzyme systems. If the rate is high the ratio approaches unity. If the rate is low, the ratio deviates from unity. In an unfertilized egg with a low  $O_2$  consumption, as in *Arbacia*, the conclusion would be that the ratio is far from unity. Sperm with a more positive redox potential would be considered to change the ratio towards unity so that more nearly equal concentration of oxidants to reductants could react with one another. Barron (1930) has shown that there is a definite relation between rate of  $O_2$  consumption of cells and the redox potential of the solution surrounding them. In other words, the purpose of the sperm would be to regulate the ratio of oxidants to reductants of the oxidation enzyme systems thereby changing the energy level to one which is necessary for beginning development. In *Arbacia*, it would need to be raised; in *Asterias*, not much change is needed as the energy level is already at a high value; in *Chaetopterus*, it would need lowering. These values agree with the rate of  $O_2$  consumption on fertilization of these three eggs.

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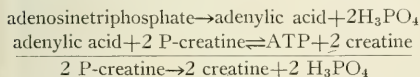
## THE MECHANICO-CHEMICAL COUPLING OF MUSCLE

WINSTON H. PRICE

*Formerly Research Assistant in Chemistry  
California Institute of Technology, Pasadena*

In 1930 Lundsgaard found that a muscle would contract when the formation of lactic acid was blocked by iodoacetate and would continue to shorten until all the phosphocreatine present in the muscle was used up. These findings ruled out the prevailing Meyerhof theory of muscle contraction.

In 1934 Lohmann investigated the adenosinetriphosphatase (ATP-ase) activity of frog muscle extract in connection with the enzymatic splitting of phosphocreatine (P-creatine). He showed that the following sequence of reactions takes place:



The second reaction occurs step-wise, leading first to the formation of adenosinediphosphate and then to ATP. No enzyme has as yet been found in muscle which can hydrolyze P-creatine directly to creatine and inorganic phosphate. The splitting of P-creatine can take place only in the presence of adenosinediphosphate or adenylic acid. These findings were important for they showed that the ATP concentration in muscle remained constant as long as P-creatine was available, and also led to the assumption that during muscle contraction the splitting of ATP preceded that of P-creatine.

Meyerhof's and Lohmann's finding that the hydrolysis of one pyrophosphate bond of ATP liberated about 12,000 calories per mole was another factor contributing to the idea that this exergonic reaction was involved in muscle contraction. Further evidence for this hypothesis has been the findings that (1) all the energy of the cell seems to be converted into phosphate bond energy, (2) inorganic phosphate is liberated from ATP during muscle activity and (3) agents such as iodoacetate, sodium fluoride and azide<sup>1</sup> which inhibit ATP synthesis in muscle also inhibit muscle activity.

New impetus was given this idea by the report of Engelhardt and co-workers that (1) myosin, the contractile protein of muscle, showed ATP-ase activity and (2) myosin threads under tension undergo an elongation on the addition of ATP; this effect depending upon the ATP-ase activity of the thread. Needham and co-workers had also found that the addition of ATP to myosin solutions caused a decrease in the viscosity and flow birefringence of the myosin.

Recently Szent-Gyorgyi and co-workers have reported the isolation of a new protein from mus-

cle which they call actin. This protein in combination with myosin forms the contractile element of muscle. This statement is based on the fact that contracting threads may only be drawn from the actomyosin complex and not from either protein alone.

Experiments were undertaken with the purpose of seeing whether, by the use of the *invitro* systems described above, some information could be obtained on the mechanico-chemical coupling of muscle. Actin was prepared according to Szent-Gyorgyi and co-workers and purified by isoelectric precipitation, alcohol precipitation and finally by precipitation as the calcium salt. This actin showed a single peak in the Tiselius apparatus whereas the preparation of Szent-Gyorgyi had shown 3 components. The calcium precipitate was dissolved in KCl and dialyzed against 0.01 M borate buffer, pH 10.0 for 20 hours in the cold. The addition of ATP (.004 M) had no effect on this actin solution. If, however, the actin solution was incubated with 0.1 M KCl for 15 minutes, the protein underwent a marked rise in viscosity and flow birefringence. Addition of ATP (.004 M) to this actin solution caused a decrease in the viscosity and flow birefringence to the value found before incubating the actin with KCl. No ATP was split during this reaction. If the ATP-ase which had been separated from myosin<sup>2</sup> was then added to this system, ATP was split and the viscosity and flow birefringence returned to the high value. Experiments indicate that it is the triphosphate bond of ATP that is essential for the lowering of the viscosity and flow birefringence of actin. Furthermore, the union between actin and ATP seems to be in the nature of a salt linkage, perhaps by combination of the phosphate groups of ATP with the amino acid side chains of the actin molecule. This combination may make some of the side groups reactive and cause a shortening of the molecule. No liberation of -SH- groups could be detected on combination of ATP<sup>1</sup> with actin. The subsequent splitting off of the high energy rich phosphate from ATP would then supply the energy needed for the relaxation and recharging of the actomyosin complex.

If one could transpose such *invitro* experiments as described above to the whole muscle, they would indicate that combination of ATP with the actomyosin complex in muscle would result in contraction and the splitting of ATP in relaxation.

<sup>1</sup> Price, *in press*.<sup>2</sup> Price and Cori, *J. Biol. Chem.* **162**, 393 (1946).

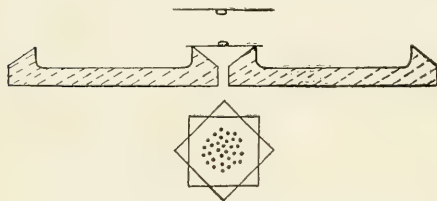


## RAPID SLIDE-MAKING METHOD FOR PREPARATIONS OF EGGS, PROTOZOA, ETC

DR. ALBERT TYLER

*Associate Professor of Embryology, California Institute of Technology, Pasadena*

Many workers have inquired about the details of a quick slide-making method to which reference was made in an earlier publication (Tyler, 1932). This note is a brief account of the method which is a modification of one described by Bêlar (1928). It consists simply of placing one coverslip containing a small drop of fixing fluid on another coverslip containing a small drop of cell suspension. The two coverslips are later separated and handled in the same manner as slides containing sectioned material. Top figure illustrates a convenient way of joining the two coverslips. One coverslip



containing the drop of cell suspension is supported on the edges of two Syracuse dishes. The second coverslip containing the drop of fixing fluid is placed crosswise (bottom figure) over the first being released as soon as the drops touch. It is important that the fixing fluid does not act for too long before the eggs are flattened, otherwise the protein and other material on the surface of the cell becomes coagulated and hardened. The cells then flatten irregularly and subsequently fail to adhere to the coverslips. It is also important to avoid evaporation from the drops. By proper adjustment of the size of the drops the degree of flattening of the cells can readily be controlled.

The fixing fluid acts rapidly on cells of small diameter especially when they are flattened. With eggs of 0.05 to 0.2 mm. diameter, two to ten minutes suffices for good fixation in Bouin's fluid. The joined coverslips are then carefully placed in a dish (one of the two Syracuse dishes used for support is convenient) and alcohol or other solution, depending upon the fixing fluid employed, is added whereupon the coverslips tend to separate. The upper coverslip can then be readily lifted off. For this purpose it is advisable to use a needle and fine forceps placed on opposite sides of the upper coverslip and to lift the latter at one edge with the forceps while preventing it from sliding by means of the needle. Sliding of one coverslip over the other will, of course, cause distortion and loss of cells or fragments thereof. Ordinarily about half of the cells will adhere to each coverslip and the two coverslips can be subsequently handled in coverslip-size staining dishes (Columbia staining dishes). Since the cells are usually flattened to the thinness (5 to 10 microns) of the usual microtome sections they can be passed equally rapidly thru the alcohols and other solutions.

This method is primarily useful for making chromosome counts, determining stage of mitosis, fertilization, etc. For such purposes it eliminates the necessity of sectioning and the concomitant difficulties resulting from having different parts of a cell in different sections. Since it involves flattening, it is obviously unsuitable for any work in which it is necessary to retain the normal shape of the cells.

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## HYPERACTIVITY OF THE ADRENAL CORTEX

DR. F. A. HARTMAN

*Professor of Physiology, Ohio State University*

At rest or under conditions of minimal activity there is a basal secretion of adrenal cortical hormones. In response to various stresses such as exercise, exposure to cold, trauma, anoxia and poisons, there is an increase in output of the hormones which subsides after the stimulus disappears. After removal of a large proportion of both adrenals by enucleation in the mouse a considerable rise in the basal secretion occurs. This higher level of secretion is maintained for months. The following table illustrates these changes. Fat and glycogen (as sugar) in the liver were determined after 24 hours starvation.

## Values indicating changes in hormone production after enucleation of both adrenals

	Total lipid %	Glycogen %
Normal	8.5	0.12
Adrenalectomized	6.3	0.04
Enucleated 2 days	6.6	
" 7 "	11.8	0.24
" 15 "	10.0	
" 29 "		0.58
" 99 "	10.0	

The wide difference in time at which the peaks for the production of the fat factor and carbohy-

drate factor occur is evidence that the two factors are not identical.

By enucleation we removed an average of 75% of the adrenal tissue. Less than 25% of active tissue remained since the circulation was disturbed and this 25 included the capsule. Thirteen days after enucleation the adrenals averaged 0.69% of the body weight which is one-half of the normal weight.

Removal of cortical tissue probably reduces the inhibitory effect on adrenotrophic hormone production by the pituitary so that after a lag of three or four days there is sufficient recovery of the remaining cortices to respond to the increased output of adrenotrophic hormone. However, the new level of cortical hormone production does not return the adrenotrophic output to the old level. Thus a higher basal level is established. The performance of a relatively small number of cortical cells indicates a large factor of safety. This capacity of cortical cells for sustained activity in disease where a large proportion of cortical tissue is destroyed is important in prolonging life.

There is now evidence for three mother hormones secreted by the adrenal cortex; the fat factor, the carbohydrate factor and the sodium factor.

## THE CYANIDE SENSITIVITY OF THE UNFERTILIZED SEA-URCHIN EGG

DR. W. A. ROBBIE

*Research Associate in Ophthalmology, State University of Iowa*

Respiration in the unfertilized sea-urchin egg is conventionally considered to be insensitive to the action of hydrocyanic acid and therefore not dependent upon catalysis by a heavy metal enzyme system. This conception is based on the reports of Runnström<sup>1</sup> and Korr<sup>2</sup>, neither of whom present enough experimental data to justify such a conclusion. Lindahl<sup>3</sup> disagrees with the assumption in a lengthy and well written paper that shows there is a definite depression of the unfertilized egg respiration by cyanide. He declares also that the characteristics of the residual oxygen consumption in the presence of cyanide indicate that a different type of oxidative system, other than that active normally, is involved.

Reinvestigation of the cyanide sensitivity of unfertilized eggs of *Arbacia punctulata*, using recently devised methods for maintaining constant concentrations of HCN in manometric experiments, gives results which are comparable to those of Lindahl. The respiration is partially inhibited by concentrations of HCN as low as  $10^{-5}$  M., and for a four hour period with  $10^{-4}$  M. it is only 40 percent of the control value. There is complete

inhibition for the first hour or more. In 4 percent  $O_2$ -96 percent  $N_2$  mixture is no depression of the respiration of the control egg, but on addition of  $10^{-4}$  M. HCN the oxygen consumption is reduced, for a four hour exposure, to 20 percent of the control level.

At concentrations of cyanide higher than  $10^{-4}$  M. there is apparently a stimulation in oxygen uptake. This is increased with high and reduced with low oxygen tensions. It is possibly associated with oxidations proceeding through a cyanide-hemin system or with the metabolism of a carbohydrate intermediate, catalyzed by HCN.

In conclusion it may be stated that most of the respiration of the unfertilized *Arbacia* egg is mediated by a heavy metal cyanide-sensitive catalytic system and that the oxygen consumption in high concentration of HCN is of a definitely different nature than the normally active mechanism.

<sup>1</sup> Runnström, J. *Protoplasma* **10**, 106 (1930).

<sup>2</sup> Korr, I. M. *Jour. Cell. and Comp. Physiol.* **10**, 461, (1937).

<sup>3</sup> Lindahl, P. E. *Ark. Kemi Mineral och Geol.* **14A**, 1 (1940).

## The Collecting Net

A fortnightly publication devoted to the scientific work at marine biological laboratories

Edited by Ware Cattell with the assistance of Ruth Scott and Jane Carruthers.

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## Introducing

Dr. Albert Dalcq, head of the department of human anatomy and embryology at the Medical School of the University of Brussels.

Dr. Dalcq has come to the United States this summer for the first time primarily to give a lecture on brain morphogenesis in vertebrates for the annual meeting of the Society for Study of Development and Growth in Kingston, Rhode Island. His trip was planned so that he would have a few weeks in Woods Hole to study the *Styela* egg, not found in European waters.

Born in Charleroi, Belgium, Dr. Dalcq graduated from the Medical School of the University of Brussels in 1919 and was appointed assistant in anatomy and embryology. He has been teaching for the past twenty-seven years; since 1930 he has been head of the department of human anatomy and embryology.

During World War I, he served as medical officer with an infantry battalion in the Belgian Congo and in World War II as head of a field hospital. After the University was closed, Dr. Dalcq, Dr. Pasteels and Dr. J. Brachet were the guests of the Royal Museum of Natural History.

As a medical student, Dr. Dalcq, worked in the laboratory of Dr. A. Brachet on spermatogenesis in reptiles and in 1920 demonstrated the reptilian x-chromosome. Beginning his embryological research with a study of gametogenesis, he has progressively studied each phase of embryology; fertilization, cleavage, gastrulation, neurulation and organogenesis. Working in Roscoff, he was able to activate the *Asterias* egg inducing parthenogenesis by means of calcium. In 1925, he began experiments on fertilization in the frog, intoxicating the spermatozoa with trypanflavine and irradiating them and also the eggs with x-ray and radium. He observed that the chromosomal substance, though irradiated or intoxicated, does have a definite action on cleavage especially on division of the centrosome and formation of the spindle.

At the general meeting of the Societe de Biologie in Paris in 1935, he gave a report stressing the original thesis of the importance of the cortical

material in morphogenesis. His book, "Form and Casualty in Early Development", expounded this thesis and pointed out that the two main factors in egg morphogenesis are a cortical field and an internal gradient and that the latter is intimately bound with the distribution of the yolk platelets.

Dr. Dalcq is now working on the fourth and last paper on a series of investigations on the role of different constituents of the egg in morphogenesis. The main conclusion from these experiments on the blastula and gastrula of the *DiscoGLOSSUS* egg, is a demonstration of predisposed areas in these early stages.

After the liberation of Belgium, Dr. Dalcq organized the "Universitas Belgica", a general association of all the Belgian scientists, of which he is the honorary secretary. This is the Belgian branch of the International Association of University Professors and Lecturers; it hopes to collaborate with UNESCO.

After visiting several former students and other embryologists, Dr. Dalcq will return to Brussels in October to rejoin his family.

DR. RICHARD VAN CLEVE, Chief of the Bureau of Marine Fisheries of the State of California, has been appointed chief biologist of the International Pacific Fisheries Commission.

PROFESSOR JOLIOT-CURIE, Director of Atomic Energy for the French Government and Chief Advisor of the French Delegation to the United Nations Atomic Energy Commission, has returned to France for consultation with the French Government. He hopes to return in September with his wife, Madame Irene Joliot-Curie.

## THE M.B.L. BEACH

### To the Editor:

The strip of land comprising the M.B.L. beach has been given to the M.B.L. as a gift for the use of the laboratory people and the town people by Mrs. Meigs and Dr. Clowes. It is not a "public" beach in the strict sense of the word, and is not designed for the use of out-of-town people, such as Sunday crowds.

The beach can be improved and extended by putting in a breakwater at the west end as planned. The boulders on the east side were placed in the hope that sand would be induced to deposit around them by breaking the wave motion. The contour of the beach is being gradually lowered. The last heavy gale lowered its level several inches. There are deposition periods as now, but our records show that during the last 20 years the beach has receded about 30 feet. Anything that can be done to stop this erosion and to build up the beach should be hailed as a constructive act. At present the beach on the east side and around the boulders and on the west side of the lower boulders gives the appearance already of better sand deposits. We are hoping that the breakwater as planned by the M.B.L. Club will materialize this fall.

—S. C. Brooks



## ITEMS OF INTEREST

DR. THOMAS HUME BISSENETTE, J. Pierpont Morgan Professor of Biology at Trinity College, has been named recipient of the Walker Grand Prize of \$1,000 by the Boston Society of Natural History for his contributions to the study of photoperiodism. Dr. Bissonnette was in charge of the invertebrate course at the Marine Biological Laboratory for several years before the war. He has recently returned from Europe where he served as one of the teachers in the university established by the U. S. Army for its troops of occupation.

DR. ROBERT GAUNT, associate professor of biology at New York University, has been appointed professor of biology and head of the department at Syracuse University.

DR. DONALD HOOKER, lecturer in physiology at the Johns Hopkins University and editor of *The American Journal of Physiology* and of *The Physiological Reviews*, died on August 13.

MR. ALFRED H. BANNER, associate professor of zoology at the University of Hawaii and a student in the M.B.L. invertebrate course, suffered a head injury in falling from the porch railing of the Old Main Building. He was released from the Cape Cod Hospital the following day and immediately resumed his work.

A grant of \$3,500 by the Research Corporation of New York to support the study of hydrolysis of proteins and the amino acid content of vegetables and fruits under the direction of Dr. Arthur R. Kemmerer, head of the department of human nutrition, has been announced by the College of Agriculture of the University of Arizona.

DR. FRED J. SEAVER, head curator of the New York Botanical Garden, recently visited Woods Hole for several days.

## THE AUGUST "BIOLOGICAL BULLETIN"

Annual report of the Marine Biological Laboratory.

Temporary pair formation in *Paramecium bursaria*, Chen, T. T.

Observations on the functioning of the alimentary system of the snail *Lymnaea stagnalis* apressa Say, Carriker, Melbourne Romaine.

Comparative sensitivity of sperm and eggs to ultraviolet radiations, Arthur C. Giese.

The influence of texture and composition of surface on the attachment of sedentary marine organisms, Pomerat, C. M. and C. M. Weiss.

The developmental history of *Amaroecium constellationum*. II. Organogenesis of larval action system, Sister Florence Marie Scott.

DR. HUGO OSVALD, Professor of Plant Husbandry at the College of Agriculture, Uppsala, Sweden and Secretary of the Executive Committee of the Seventh International Botanical Congress, has been visiting the U.S.A. On July 20 he was the guest of the American Officers of the Botanical Section of the International Union of Biological Sciences (the official holdover committee of the congresses) at Harvard University, with whom he discussed plans for the next Congress. This will be held in Stockholm, in the early summer of 1950. Dr. Frans Verdoorn, Botanical Secretary of the Union has, at the request of the Executive Committee, undertaken to prepare a new international plant science register and directory (along the lines of the early volumes of *Chronica Botanica*), this will be issued about a year before the congress.

## MONOGRAPH BY DR. WRINCH

A monograph by Dr. Dorothy Wrinch, written largely at the Marine Biological Laboratory during the last two Summers and entitled *Fourier Transforms and Structure Factors*, has just been published by the American Society for X-Ray and Electron Diffraction.

The monograph, part of a long-term research on the structure of the native proteins, has two aspects. On the one hand, it is presented as a contribution to the study of structure factors—or Fourier transforms—of atomic groupings which occur frequently in a wide variety of crystals, both organic and inorganic. Thus special attention is given to such cases as tetrahedral, octahedral and hexagonal arrays of like atoms. A section on the structure factors of small crystals is also included.

On the other hand, it is presented as a contribution to the x-ray analysis of macromolecular crystals. These crystals confront crystallography with a new problem, since the structure of the molecules and indeed, to some extent, even the composition of the molecules is unknown. It is the belief of the author that a systematic study of what may be called the *language of structure factors* is a necessary preliminary to the interpretation of the intensity maps of crystals made up of macromolecules of unknown structure. In the sequel the structure factors of distributions of different structural types are recorded. Such mathematical facts provide material for the study of the relationship between distributions and their structure factors, the fundamental theme throughout the monograph.

## THE GENERAL SCIENTIFIC MEETINGS AT MARINE BIOLOGICAL LABORATORY

The following papers composed the General Scientific Meeting on August 23 and 24:

Correlated Histories of Individual Sease Organs and their Nerves, as seen in living frog tadpoles, C. C. SPEIDEL; Some Properties of Purified Squid Visual Pigment, A. F. BLISS; "Accommodation" and Opening Excitation in Muscle and Nerve, Evidence for Enzymatic Participation in The Penetration of the Human Erythrocyte by Glycerol, P. G. LEFEVRE; Arterial Anastomoses, E. R. CLARK and ELEANOR L. CLARK.

Vascular Reactions to Ergonovine Maleate as seen directly with the Microscope in the Living Mammal, R. G. ABELL; Effects of Prolonged Starvation on the Lipids in *Phascolosoma gouldii*, C. G. WILBER; The Effect of Halogenated Alkyl Amines on the Respiration of Sea Urchin Sperm and Eggs, E. S. G. BARRON, H. NARAHARA, E. G. MENDES; The Effect of Uranyl Nitrate on the Respiration of Sea Urchin Sperm, D. BENEDICT and E. S. G. BARRON; The Distribution of Lipid between the Light and Heavy Halves of the Arbacia Egg, F. R. HUNTER and A. K. PARFARI; A Photometric study of the kinetics of fibrin Formation, J. LEIN.

The Effect of Roentgen Radiation on Photoplastic Viscosity Changes During Mitosis, W. L. WILSON; The Effects of U. V. Rays on Styela Eggs, ALBERT DALCO; Protoplasmic Clotting in Isolated Muscle Fibers, A. A. WOODWARD; Studies on the Viscosity and Elasticity of Striated Muscle, MANFRED BRUST; The Effect of Iodoacetate on the Changes in Muscular Latency Induced by Activity, A. SANDOW; Biological Specificity and the Synthesis of Native Proteins, D. WRINCH; A Correlation between Gill Surface

and Activity in Marine Fishes, I. E. GRAY; Nuclear Membrane Formation, etc, in *Chaos chaos* and *C. neos*, A. A. SCHAEFFER.

Certain Aspects of the Physiology and Histology of Luminescence in the "Railroad Worm", J. B. BUCK; A Comparative Study of Cholinesterase Activity in Norman and Genetically Deficient embryos of *Drosophila*, E. J. BOELL; Hormone Regulation of Dehydrogenase Activity of Crustacean Tissues, E. KUNTZ; Possible Metabolic and Physical-Chemical Factors in the Production or the Injury Potential in Spider Crab Nerve, A. M. SHANES; Some Effects of Tannic Acid on Osmotic Hemolysis, T. H. WILSON and M. H. JACOBS; Shape Changes in the Denuded Nereis Egg Preceding First Cleavage, A. T. JONES; Effect of Caffeine Concentration upon Retardation of Arbacia development, R. H. CHENEY.

### Demonstrations

Quantitative Micro-Colorimetric Analysis in Volumes of 0.1cc, ARNOLD LAZAROW; Electron Microscope Pictures of Human and Invertebrate Spermatozoa, ALBERT TYLER; A Photoelectric Counter for Use with the Microscope, D. M. LILLY; Simplified Ultraviolet Microscopy, GEORGE I. LAVIN; Cartesian Diver and Filler Magnetic Flea Stirrer and Microburette, C. L. CLAFF; A Sample Filter for use with the M. B. L. Sea Water System, C. H. TAFT and E. P. LITTLE; Mutants and Mosaics of *Habrobracon*; Life History of the *Melittobia*, P. W. WHITING and ANNA R. WHITING.

The papers were presented in the Auditorium; the demonstrations in the rooms of the demonstrators. This is the first General Scientific Meeting that has been held since the war began.

### THE WOODS HOLE COMMUNITY HALL

The Woods Hole Community Association is soliciting \$2,879.00 this summer for the purpose of renovating and repairing the Community Hall. This amount includes the cost of repairing leaks in the roof; installing new lighting fixtures in the upper and lower halls; improving the heating system by the addition of storm windows and doors; plastering above the stage and in the upper hall; screening the windows of the upper hall to provide for athletic activities; obtaining new curtains for the stage; a new pool table and a phonograph.

Donations to provide for the improvements to the Hall may be made to Mrs. Oscar Hilton, the Treasurer of the Association, as well as the regular membership dues of \$1.00 annually.

### THE M.B.L. FAUNAL AND FLORAL FILE

One of the chief purposes of the M.B.L. Faunal and Floral File Catalogue is to record systematically for the entire year the reproductive and ecological habits and also the basic experimental reactions of the marine animals and plants of the Woods Hole area.

For more than thirty years such records have not been kept up-to-date. In addition to certain confusions, this has resulted in repeating many elementary time-consuming observations of animal and plant reactions.

For the benefit of investigators and students it is requested that the Faunal and Floral Cards be filled as completely and accurately as possible and returned to the Naturalist. Only in this way, can the Laboratory build and maintain a useful and practical guide. —D.Z.

## A NEW FACTOR FROM THE ADRENAL INFLUENCING FAT DEPOSITION IN THE LIVER

DR. KATHERINE A. BROWNELL

*Research Associate, Ohio State University*

Starvation in the normal mouse leads to a large deposition of fat in the liver. This fails to occur after adrenalectomy. With these facts as a basis we have developed a test for a fat factor in various fractions prepared from ox adrenals.

The method is briefly as follows: Adrenalectomized mice are fed for 24 hours then fasted for 24 hours. During this 48 hour period they are injected every six hours with 0.2 cc of the preparation to be tested. Two to three hours after the final injection, the livers are removed and the total lipid determined gravimetrically.

Over 30 fractions from the adrenal gland, including crystalline compounds, have been tested by this method. The table shows results on adrenalectomized untreated animals, two fractions, a whole extract from which these fractions were taken and three crystalline compounds already proven to have glyconeogenic potency. Both fractions are crude being specific in only one respect, namely, that the carbohydrate factor fraction has no electrolyte potency and the sodium factor fraction no glyconeogenic potency. The only fraction that gave a highly significant response was that containing the carbohydrate factor. The low response given by whole extract, we attribute to inhibiting substances, three of which have been tested.

Since the liver fat response was given almost exclusively by the carbohydrate factor fraction, some of the crystalline compounds having glyconeogenic properties were tried to determine whether or not they were responsible. The table shows that the only one used which gave a significant response was dehydrocorticosterone; a 25% increase over the control level and in order to obtain this response, two and one-half times as much pure substance (0.96 mgm) was used as that estimated to be present in our carbohydrate factor fraction (0.35 mgm). The other two compounds; corticosterone and 17-hydroxy-11-dehydrocorticosterone gave liver fat responses only on the borderline of significance and to obtain even these small responses two to two and one-half times as much material was used as that estimated to be present in the carbohydrate factor fraction. The fourth known glyconeogenic compound, hydroxycorticosterone, we were unable to test because of the lack of material.

There remain two possibilities: (1) That hydroxycorticosterone is the fat factor. If so, the effect on fat metabolism is a new property; (2) that there is in the carbohydrate factor fraction a new factor regulating fat deposition in the liver.

### Effect of Adrenal Fractions on Deposition of Fat in the Liver

Treatment	No. of Animals	Total Lipid %	Increase %
Adept. untreated	29	6.31	
Carbo. Factor Fraction*	15	8.42	33
Na Factor Fraction	7	6.74	9
Whole Extract*	7	7.13	13
Dehydrocorticosterone†	8	7.87	25
Corticosterone‡	8	7.11	13
17-hydroxy-11-dehydrocorticosterone‡	7	6.87	9

\*The extracts represent 300 gms. tissue per cc.

†The solutions of crystals represent 0.6 mgm. solid per cc.

### STEPS IN THE VISUAL CYCLE

(Continued from Page 45)

rhodopsin is an unstable lipid, appropriately called Transient Orange. This complex lipid has been subjected to numerous chemical tests by Krause. It bleaches rapidly at room temperature to another lipid with properties suggested by its name, Indicator Yellow. This substance is bright red in acid, and pale yellow in base. At low temperatures it reacts to pH very slowly. The spectral absorption maxima and the similar effect of base on Transient Orange and Indicator Yellow at 3°C suggest that the primary product of bleaching rhodopsin is the acid tautomer of Indicator Yellow.

In the meantime, the end products of the bleaching cycle were studied by Wald, who found that retinas, shaken with petroleum ether soon after bleaching, yielded a greenish yellow carotenoid, retinene. After standing for an hour following bleaching by light, retinene was no longer found but was replaced by Vitamin A. Retinene, however, seems not to be a normal component of the visual cycle, but rather the result of a side reaction of the acid tautomer of Indicator Yellow, which has been followed in chloroform extracts.

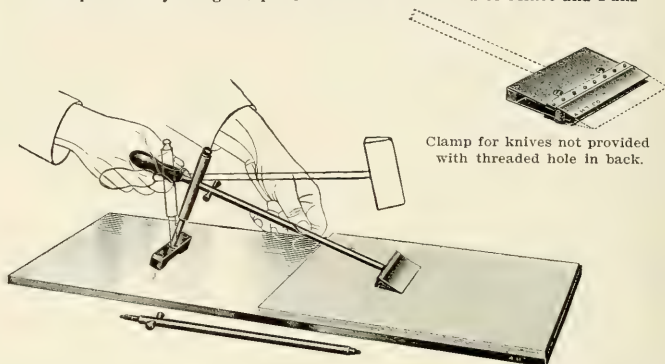
In the retina or in fresh neutral extracts retinene does not accumulate. Instead the acid Indicator Yellow bleaches, and is replaced by Vitamin A. This conversion is effected by a labile protein. The formation of Vitamin A is the predominant final bleaching step in the excised retina or in fresh extracts. In the dark there is a partial regeneration of visual purple through the Indicator Yellow stage. It is not as yet known whether Vitamin A participates in the partial regeneration found under these conditions. In the living animal there occurs an extended regeneration of rhodopsin from Vitamin A stored in the black pigment epithelium during light adaptation.<sup>1</sup>

<sup>1</sup>Greenberg and Popper, *Am. J. Phys.* (1941).



## SCHMID HAND MODEL MICROTOME KNIFE SHARPENER

For operation by the glass plate and abrasive method of Minot and Fanz



7207-N.

Schmid Hand Sharpener for use with Knives with threaded hole in back.

**MICROTOME KNIFE SHARPENER, Schmid Hand Model.** For operation by the glass plate and abrasive method as first suggested by Minot and later developed by Fanz. See N. Graham Stabler, "A New Device for Honing Microtome Knives on Glass," *The Journal of Laboratory and Clinical Medicine*, Vol. XVII, No. 4 (January, 1932), p. 378.

The Hand Sharpener consists of a vertical support of Stainless steel mounted on a fibre bar and two rods of Stainless steel, with wooden handle, one rod threaded for direct insertion into the hole in back of Schmid Knives 80 and 110 mm, and the other rod threaded for insertion either in Schmid knives 125 to 250 mm, incl., or in the back of Knife Clamp for knives not provided with hole in back. The knife, or knife clamp is attached to the rod, which is placed in the vertical support at an angle determined by insertion in one of a series of eight holes. The support is moved by hand, in a diagonal direction, on the polished glass base plate. After each stroke, the knife is lifted and reversed as indicated. The use of a honing guide or back is entirely obviated and the necessary skill—much less than required for stone honing—is quickly acquired.

The upper glass or grinding plate, on which the abrasive solution is spread, is 14 inches square x  $\frac{1}{2}$ -inch thick, with plane matte surface on one side and polished on the other. The glass base plate is 28 inches long x 14 inches wide x  $\frac{1}{2}$  inch thick, with surface polished and edges ground.

The following abrasives and accessories are supplied with each outfit:

- |  |                                     |
|--|-------------------------------------|
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| 2 Brushes, Camels Hair, flat, 2-inch         | 1 lb. Turkish Emery, FFF            |
| 1 Petri Dish, Pyrex brand glass, 100 x 15 mm | 1 lb. White Rouge (Silicon Dioxide) |
| 6 Test Tubes, 300 x 15 mm                    | 4 oz. Glycerine, c.p., neutral 98%  |

7207-N. Microtome Knife Sharpener, Schmid Hand Model, as above described, complete outfit for use with Schmid knives with threaded hole in back, consisting of sharpener with two Stainless steel rods, glass base plate and upper grinding plate and outfit of abrasives and accessories. With detailed directions for use.....30.75

7207-P. Ditto, but with the addition of Knife Clamp for use with knives not provided with threaded hole in back. Takes knives up to 12 mm thickness of back.....43.25

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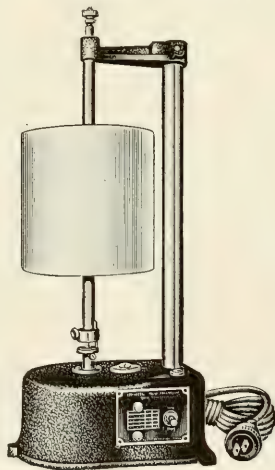
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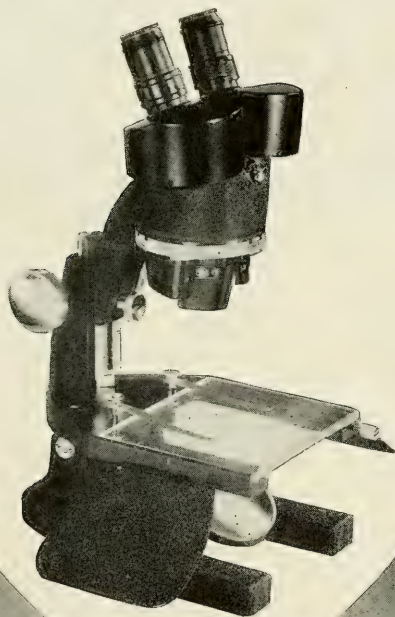


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